ENGINEERING NEWS

——THE AM. SOC. C. E. PRESIDENTIAL CONTEST resulted in the election as President of MAX. J. BECKER, Chief Engineer, Pittsburg, Cincinnati & St. Louis Railway, by 311 votes, against 282 votes for THOS. C. CLARKE, of this city, the opposition candidate, and 3 scattering. The total number of votes cast was thus 595 out of 944 members entitled to vote; but 16 ballots were thrown out for non-payment of dues, and 12 for lack of signature on the back, making 624 who attempted to vote. The remainder of the regular ticket was all elected.

The Norman medal was awarded to Mr. E. F. RUSSELL TRATMAN, of the editorial staff of this journal, for his paper on "English Railway Track;" and the Rowland prize to Mr. CLEMENS HERSCHEL, of Holyoke, Mass., on "The Venturi Water Meter;" both awards being well deserved compliments for valuable papers. A valuable paper on the "Relation of the Form of Railway Wheels and Rails" was read by DON. J. WHITTEMORE, in discussion of the recent committee report on that subject, and Mr. SANDFORD FLEMING reported good progress with the 24 o'clock time reform. The proceedings were otherwise without special interest. The growth of the Society last year was the largest in its history, as shown by the statistics elsewhere.

——PANAMA REORGANIZATION SCHEMES spring up almost daily, thus helping to let tired ones down easy. There is hardly the ghost of a chance that any of these schemes will amount to anything, as the completion of the canal in permanent shape, including the control of the Chagres and the establishment of permanent slopes, will still cost a vast sum of money, and this department of the work has hardly been touched. In the mean time the contractors are shutting down and the company re-employing the discharged laborers *pro tem.*, and too rapid discharge, which will imperil public order has been avoided by pledge of the Panama Railroad stock issued by the company, about its only available and valuable assets.

——A NEW SYSTEM OF HAULAGE FOR CANAL BOATS has been invented by M. MAURICE LEVY, Engineer-in-Chief of French canals. The invention consists in the employment of a metallic endless cable running along the two banks upon supports furnished with pulleys. The boats—which attain a speed of about 5 miles an hour, or about 50 per cent., faster than by ordinary towage—can be readily attached to and detached from the cables. We do not see why the idea is not a good one.

——BIGGER OCEAN STEAMERS are the order of the day. A new ocean steamship of 10,500 tons by the White Star Line is to make its first trip in May, and now the report comes that the Guion Co. has a vessel of 11,500 tons in contemplation. The model, which is the last by Sir WILLIAM PEARCE, has been on exhibition at the Maritime Exchange in Glasgow for several months. Sir WILLIAM PEARCE was the President of the Fairfield Shipbuilding and Engineering Co., successors to John Elder & Co., Clyde shipbuilders, and of the Guion Steamship Co., also. He was the designer and builder of the *Arizona*, *Alaska*, *Oregon*, *Umbria*, and *Etruria*, and of all the larger and later steamers of the North German Lloyds, besides several that are engaged in the East Indian and Oriental trade.

——THE COMMERCE ON THE ST. MARY'S CANAL, for 1888, is reported upon as follows by Gen. O. M. POE: The canal was open to navigation from May 7 to Dec. 4. There was a decrease of 1,552 in the number of vessels of all kinds which passed through the canal, but there was an increase of 233,061 tons in the registered tonnage, indicating an increase of 37 per cent. in the average size of the vessels used. The amount of freight transported during the year was 916,776 tons greater than last year, though three new lines of railroad now compete with the canal. The value of the commerce shows an increase of only a little more than $3,000,000,000 and the report ascribes this to the decrease in shipments of grain, manufactured iron and copper.

——THE CHINESE NAVY IS FAST BECOMING A VERY formidable force. It is stated that there are now three powerful squadrons of Chinese men-of-war, armed with the latest type of ordnance, and well manned and equipped, in every respect able to cope with European ironclads.

——A NEW EAST RIVER BRIDGE sentiment is being actively worked up in East Brooklyn. It is to cross from about the foot of Broadway, Brooklyn, to about the foot of Grand St. New York. A bill is now before the legislature incorporating a company, but not on a basis affording much hope of early construction. The bridge is needed and ought to be built; but unless its New York terminus is very near the City Hall, it will not relieve the present bridge by any perceptible amount, and even if it is, it will not relieve it much.

——THE BARNES-MARTIN PLANS for improving the Brooklyn Bridge transit facilities, which were adopted by the Trustees in April last, in preference to those recommended by their Board of Experts, it was reported at the last meeting of the Trustees on Monday last, according to the New York *Times*, are "being perfected. It is believed that they will be far enough advanced to begin work at the Brooklyn end in the spring and at the New York end in the fall." This allows an interval of a year and a half from the time the plans were formally adopted on the alleged ground of cheapness and simplicity, for perfecting them so as to be able to start work on the end where relief is most important. A breeze was started about certain of the trustees selling goods to the bridge, which it was found had a basis of fact, but not such as to justly indicate any abuse of official power in this respect.

——THE WORST ACCIDENT OF THE WEEK, and of many weeks, was a collision between a passenger and freight on the New York, Penna. & Ohio R. R., a road which has lately had a good many accidents, in somewhat striking contrast with its former almost complete exemption for a long period of years. The traffic however, is now much heavier, a fact which alone suffices to explain a considerable difference. A freight train had broken in two and the rear part was left on the track with a brakeman to flag. He thought he heard a whistle signal to call him in, and left. The weather was foggy, and the collision followed almost immediately, killing 4 outright and wounding 6. Then followed a holocaust, the first of moment this winter, causing 4 more deaths by fire. A poor little girl traveling alone was caught between the seats and slowly burned alive; 3 out of 7 Chinamen shared the same fate. The sleepers were saved. Good freight couplers, air brakes on freight trains and steam heating of passenger trains would have saved all these lives, and all danger of accident. These devices have all passed the probationary experimental stage. It will not be long before such occurences will be wholly inexcusable.

——THE BOILER of engine No. 24 of the Cincinnati, Indianapolis, St. Louis & Chicago, exploded Jan. 5 near Cincinnati, O., while hauling a passenger train. Two men were injured, one fatally.

——A BROKEN CAR WHEEL wrecked a Delaware & Hudson freight train near Harpersville, N. Y., on Jan. 11, and one man was killed.

——WASHOUTS occurred recently on the Lake Shore & Michigan Southern between Buffalo and East Hamburg. The tracks are about 3 ft. above ordinary lake level, but the waves caused by the recent gale washed out the track for about 2 miles.——A landslide occurred Jan. 8 on the New York Central between Bath and Troy, N. Y. The engineer of an express train to Montreal saw the earth sliding and tried to stop the train, but the slide caught the engine and tender and threw them over on the adjoining track, the engine falling on its side; two cars were derailed.

——A RAILWAY TRESTLE between Sturgis & Tilford, Dak., was partly burnt on Jan. 11.

——AN EARTHQUAKE SHOCK was felt Jan. 11 at Dannemora, Plattsburg, Saranac Lake, and other points in New York.

ACTION AGAINST GRADE CROSSINGS is renewed by the New York Railroad Commission in a bill for separation of grades, for building any new grade crossings of highways or other railways, and providing for gradual elimination of those now existing. The Commission in an accompanying report allude favorably to the works proposed or in progress at Buffalo, Jersey City, Hartford and Springfield. The Governor's late message shows that in 61 cases in Connecticut the towns paid $49,195 and the companies $304,433. There are 1,200 grade crossings in the State. In New York there were 42 killed and 57 injured at highway crossings in 1887, against 28 and 34 in 1888. In Hudson Co., N. J., 454 persons have been killed in 10 years; 133 have been killed in Philadelphia in 3 years; 19 last year in Massachusetts; and by only 3 roads in Chicago 26 were killed last year.

——ACCIDENTS ON BRITISH RAILWAYS in the 9 months, from Jan. 1 to Sept. 30, caused the death of 11 passengers and 5 employés. In the same period there were 63 passengers and 270 employés killed from other causes—at crossings and while moving about the yards, or more than 20 times as many.

——THE TOTAL TRUNK LINE TRAFFIC from Chicago eastward in 1888 aggregated 1,769,457 tons, against 1,711,289 tons in 1887. This was distributed as follows among the several lines:

	1887.	1888.
Michigan Central	238,479	209,747
Lake Shore & Mich. Southern	243,095	275,574
New York, Chicago & St. Louis	153,254	167,853
Total by Vanderbilt Lines	634,798	653,174
Chicago, St. Louis & Pittsburg	292,407	171,133
Pittsburg, Ft. Wayne & Chicago	278,346	252,350
Total by Penna. Lines	480,843	423,483
Baltimore & Ohio	128,615	175,256
Grand Trunk	234,084	304,849
Chicago & Atlantic	232,349	212,695
Total	1,711,289	1,769,457

——EARNINGS of some of the principal railway companies for 1888, are reported by the *Financial Chronicle*, and shows on 103 roads a total of $386,626,292, an increase of $12,056,927 or 3.49 per cent. over 1887. "The railroads did a very large business, in many if not most cases surpassing anything before known in their history. But the bitterness and strife among the lines in the West was also almost unsurpassed, and it is for this that the year will always be distinguished." Thus while there has been a slight gain in gross receipts, the net earnings have greatly fallen off. Among the principal companies showing increased earnings for the year, are the Southern Pacific, $7,250,000; Northern Pacific, $4,186,982, and Canadian Pacific, $1,589,681. The New York Central shows a decrease of $1,012,440, the Grand Trunk a decrease of $1,049,070, and the Missouri, Kansas & Texas a decrease of $1,115,132.

——THE RUSSIAN MINISTER OF RAILWAYS, according to a correspondent of *Industries*, proposes asking for a credit of 9,300,000 roubles for the purchase of 300 locomotives, at an average price of 31,000 roubles each. This, at the nominal value of the rouble, 75 cts., would make their cost $23,250 each, and the total sum sufficient to purchase over 700 locomotives in this country. The value of the paper rouble has risen from 38.6 cts. in February to 46 in June, and a fair average value for that time is very near 41 cts. This would bring the cost of the engines to $12,710 each, which is still sufficiently dear for their probable weight. The engines are all to be built in Russian shops, and an order for 90 has already been placed.

——PARIS TELEGRAMS make the ominous announcement, that M. FREYCINET intends asking shortly for a grant of $42,000,000, for the construction of two lines of railway, which are intended to facilitate the mobilization of troops whenever required.

——A LIBERAL IRRIGATION APPROPRIATION is recommended by Secretary VILAS in forwarding, on Jan. 2, the report of Maj. J. W. POWELL on the preliminary surveys of the arid lands of the West for the purpose of irrigation. Mr. VILAS recommends that $350,000 be immediately available for investigating the extent to which the arid region of the United States can be redeemed by irrigation; the segregation of the irrigated lands in such a region, and for the selection of sites for reservoirs and other hydraulic works necessary for the storage and utilization of water for irrigation, and the prevention of floods and to make the necessary maps including the pay of employés in the field and office, etc.

——THE NEW CROTON AQUEDUCT, says Prest. DUANE of the Aqueduct Commission, will not afford any considerable relief to the City before the spring of 1891. The aqueduct proper will deliver water from Croton Lake to 135th. St. gate house on or before Dec. 31, 1889. But additional storage basins must be built before any real relief can be expected. The Sodom Reservoir will be finished under the contract by Jan. 1890; and supposing that the spring floods of that year fill it, it would give another 25,000,000 galls. daily, or an addition of 22 per cent. over the present daily supply. It is highly probable, however, that it may not be filled in 1890, owing to an unforeseen delay, and the addition would be postponed until the next year;

——THE COLORADO COAL & IRON CO. contemplates the irrigation of about 10,000 acres, near Pueblo, by means of long canals or pumping. As the circumstances are not favorable to the canals, pumping may be resorted to.

——INDUSTRIAL REVIEWS OF THE YEAR 1888 which have appeared in several of the English journals express their views without exception that the improved state of trade which has characterized the last half of 1888 is likely to continue well into 1889, if not through it.

——THE DULUTH BRIDGE across the ship canal is unfavorably reported upon by the Chief of Engineers, U. S. A. He says that the proposal is to build a bridge at the extreme end of Lake Superior, at the harbor of Duluth, at a point more exposed probably than any other harbor on the lake to seas of destructive violence, and that the entrance to this harbor is now extremely difficult and dangerous. In view of these facts, it would be adverse to the interests of commerce and navigation to add to these dangers by erecting a bridge at this point.

——SHIP BUILDING IN MAINE amounted to 16,120 tons last year and promises better for 1889. The bulk of this output was in the shape of large 3 and 4 masted schooners; only one square-rigged ship was built.

——THE GUATEMALA CENTRAL RAILWAY runs from the port of San José, on the Pacific coast, to the capital city of Guatemala. Length of main line, 71.8 miles; Guarda Viejo branch, 1 mile; side tracks, 2.5 miles. Gauge, 3 ft. The highest elevation is 5,010 ft. above sea level. The cross ties are about half of native hard wood and half of California red wood; there are 2,600 to 3,000 per mile. The rolling stock includes 9 engines, 11 passenger cars and 85 freight cars. The original concession was granted to an Englishman in 1871, but as no work was done it was forfeited. In 1871 a concession was obtained by WM. NANNE, an American, and the road was opened in 1880. The line receives a subsidy from the Government of $100,000 per annum for 25 years.

The East Orange, N. J., Sewerage System.

Many towns in this country have neglected the sewerage question for the simple reason that they have had no natural outlet in the shape of a stream of such size as not to be polluted in itself if made to serve the purposes of a sewer; and so they have depended upon the convenient cesspool and vault which will receive uncomplainingly refuse of every description, and will only make known its presence by occasionally contaminating a neighboring well, or emitting a few individual stenches in no way conducive to health. For this reason all the features of the recently completed system of sewerage at East Orange will be carefully studied, and the results of its operation closely watched, since it is the first example in this country of the small pipe or separate system of sewage collection and local purification. This method has been in successful operation in several large towns in England, where it has been brought to a high degree of perfection by the application of specially designed machinery and the intelligent consideration of the chemical part of the problem.

The Oranges are located in a rolling country, the topography of which, in the case of East Orange, is extremely simple. Three parallel ridges, or low hills, run nearly due north and south. All the ridges are dry and belong to the new red sandstone formation. They are occupied by houses, the valleys being unoccupied, as better foundations and natural drainage can be obtained on the hills. Two miles of streets had, therefore, to be opened, in the sense of being recognized as highways by the authorities, for the valley line sewers in order to meet the wants of a future population. The cesspools in all the valleys had become offensive since they received the drainage from the ridges, and the ground drainage being slow the earth had become saturated. It became absolutely necessary to drain the Brick Church section as it was the most thickly settled, and as the soils had there become most polluted. This led to the sewering of the others. The population of East Orange is about 12,000, and the area 3.74 sq. miles.

For the benefit of those towns which are considering this question we will briefly outline the course pursued by the authorities of East Orange. Having reached the conclusion, in the summer of 1884, that sewerage was imperatively needed, the Township Committee had preliminary plans and estimates of cost made. Previous to this the Legislature had passed an act to provide for drainage and sewerage in densely populated townships in which there was a public water supply. This act empowers any townships in the State, having a population of not less than 2,000 to the square mile and a public water supply, to construct a system of sewerage, or drainage, or both; to have plans and estimates made; to build sewers and drains in any part of the township; and, if necessary, to appropriate any lands required; to build, if the township committee shall deem it advisable, a sewer to tidewater, and for this purpose to pass through territory situated within the bounds of any other municipal corporation; to contract with the authorities of any city whose territory adjoins that of the townships for the privilege to connect the sewers of the township with those of the city; to purchase land and erect suitable buildings in order to properly deodorize, utilize, or dispose of the sewage by sale or otherwise; to apply to the circuit court of the county for the appointment of three commissioners to condemn required lands; to borrow money from time to time to pay for the public works, and to secure the payment of the same by issuing corporate bonds at a rate not to exceed 6 per cent. and to an amount not to exceed 10 per cent. of the assessed valuation of property in the townships; the legal voters at their annual meeting to decide the sum to be expended by the committee during the year. Provision is made for the payment of the principal and interest of the bonds by the committee directing the assessor to assess property in a sum equal to the principal and interest which will fall due during the year.

Three methods of disposal were considered by the Committee: to connect with the sewers of Newark; to pass through Newark, cross the meadows, and reach tide-water at Newark Bay; or to dispose of the sewage by purification at works located within the township. The first mentioned plan was abandoned, as the city of Newark refused permission. The line to tide-water was thought to be too expensive. It was finally agreed to use the separate or "small pipe" system, so arranged as to carry the sewage to some comparatively sparsely settled locality within the township limits and there by the use of chemicals, Johnson's filter presses and the intermittent filtration system, so purify it so to render the effluent sufficiently clean to permit of its discharge into the running streams of the county. Mr. C. PH. BASSETT, was engaged to prepare working drawings and specifications in accordance with the report submitted by Messrs. BASSETT & NUTE which recommended the small pipe system. The plans as prepared were examined and approved by Mr. RUDOLPH HERING. Bonds to the amount of $250,000 were issued, and in August 1886 a contract for furnishing and laying sewers, flush tanks, manholes, etc., was let to Mr. B. T. COYLE for $135,257, bonds amounting to $30,000 being furnished. Work was begun in September of the same year. In parenthesis we may here state that the contract was afterward thrown up, the material to be passed through proving exceptionally difficult to work. After this the work was carried on and completed by the committee, Mr. BASSETT being the engineer.

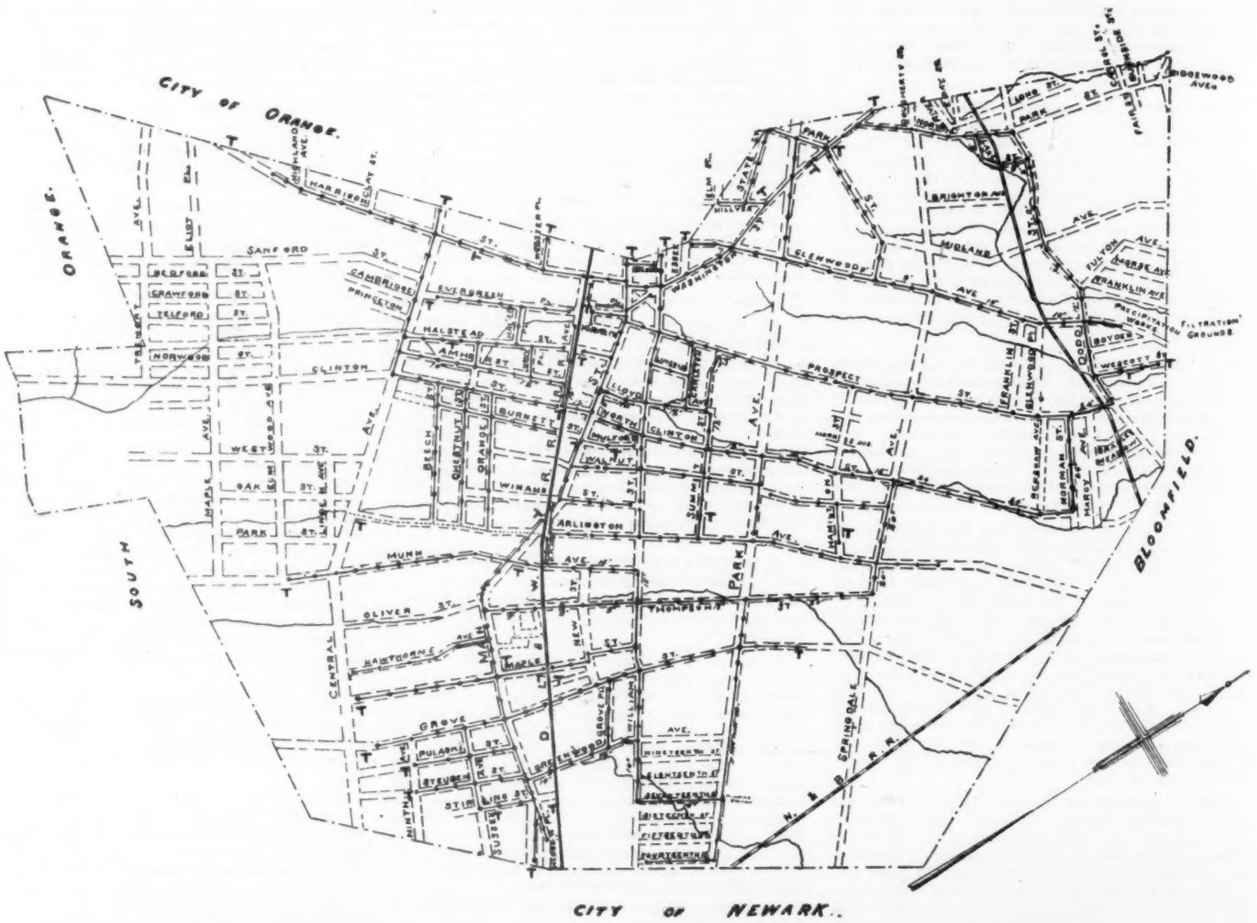


Fig. 1.—East Orange Sewerage System; Plan showing Position and Size of Sewers. C. PH. BASSETT, *Engineer*.

The pipe system is shown on the accompanying map, Fig. 1. The entire length of sewer is 27 miles. The diameters and lengths of pipe were:

10,000	lin. ft. of	8-in.	60,000	lin. ft. of	15 in.
15,000	"	9 "	90,000	"	18 "
22,000	"	10 "	125,000	"	20 "
40,000	"	12 "			

There were also added one 24-in. pipe and one egg shaped brick sewer 2 x 3 ft. All the house connections are of 4-in. pipe. The pipe is vitrified, salt glazed, circular section. The 8-in. pipe was adopted

as the smallest, as it cost but a trifle more than the 6-in., and formed a line not so liable to clog. The egg-shaped sewer, of the section of which we show a rough sketch, passes through a tunnel on the line of Arlington Ave. for a distance of 1,700 ft., six shafts being used in construction. Several reasons led to the use of a tunnel at this particular point, rather than an open cut. The maximum depth

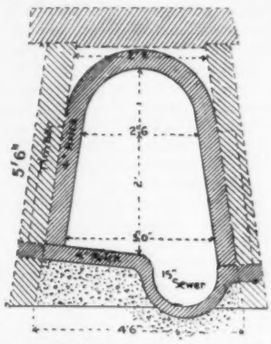


Fig 2.—Sketch Showing Section of Brick Sewer.

below the surface was 31½ ft. The line is crossed by a railroad and street car route; it passes near the depot and business portion of the town where there is much travel, and it runs by large buildings. The half-section of the sewer is 15 ins. The invert table is for a walk, and is intended to carry a pipe to relieve that portion of the town from storm-water, which had caused much trouble. The sewer is 4 ins. thick, except between the timbers where it is extended to increase the strength.

Fifty automatic flush tanks, having a capacity of 400 gal's. each, and supplied with water from the public system, are placed at points indicated by *T*, on the map. Two styles of tanks are used, the Van Vrancken and the Standard Automat'c. In the former the outer or longer leg of the siphon is provided with a tipping box into which the end of the leg enters. The water enters the tank, and flows over the bend to the box, which, upon receiving a certain quantity, tilts and allows the water and slightly compressed air in the siphon to pass down and thereby establish the flow. In the Standard the siphon is made of two lengths of vitrified pipe, having diameters of 6 and 10 ins. and placed concentrically. The upper end of the outer pipe is closed by an air-tight iron plate, provided with a valve opening downward, when a float attached to a lever is lifted. The inner pipe leads to the sewer, and at its lower end is furnished with a **U**-trap. The water from the tank rises between the pipes, compressing the air, which is prevented from wholly escaping by the water in the trap. When the rising water lifts the float, the valve is opened and the compressed air allowed to escape. The water between the pipes, having been kept at a lower level than that in the tank by the confined air, now rises and flows down the inner pipe. This lowers the water in the tank, closes the valves and establishes the flow.

About 400 acres are drained to Park Ave. and 17th St., where the elevation is about the same as at the disposal station. In a vault at this point are placed two pumps operated by a 4 H. P. gas engine. The sewage enters from two lines and is raised 25 ft., when it flows by gravity to the station. A relief overflow is provided in case of accident.

The minimum grade is 1 in 800.

We now reach the disposal works, of which we published an engraving in our last issue, and of which we herewith present drawings showing the interior arrangement of the building and the disposition of the appliances. Briefly outlined the method is as follows: The entering sewage is mixed with chemicals to precipitate the solid matter in a series of large tanks. The liquid is drawn off to properly prepared and drained ground through which it filters. The sludge receives further chemicals and passes to the press, from which it is taken in the form of cakes, having but a very slight odor.

The sewage enters the building at the top of a so-called salmon ladder. This is a flume 3 ft. wide by 3 deep and having an inclination of 1 in 50. Upon each side of the flume are projecting blades arranged in such a way that those of one side enter between those of the other. Each blade causes the flowing sewage to whirl and agitates it, thereby insuring its perfect mixing with the chemicals which enter the ladder from the mixers, the form and location of which are shown in Fig. 3.

In the bottom of the mixer is placed a perforated tray upon which the chemicals, lime and sulphate of alumina, are deposited. Air under pressure is admitted through an opening in the bottom of the mixer, which resembles a very wide inverted bottle, and, passing through the perforated tray, violently agitates the water and insures a saturated solution of the chemicals. This solution is then admitted to the inflowing sewage at the top of the ladder in the proportion of 10 grains of the sulphate and 8 grains of lime to the gallon of sewage. The sewage is then admitted to the tanks shown in Fig. 4, where the solid matter is thrown down. This building is divided into two sets of tanks by a central wall

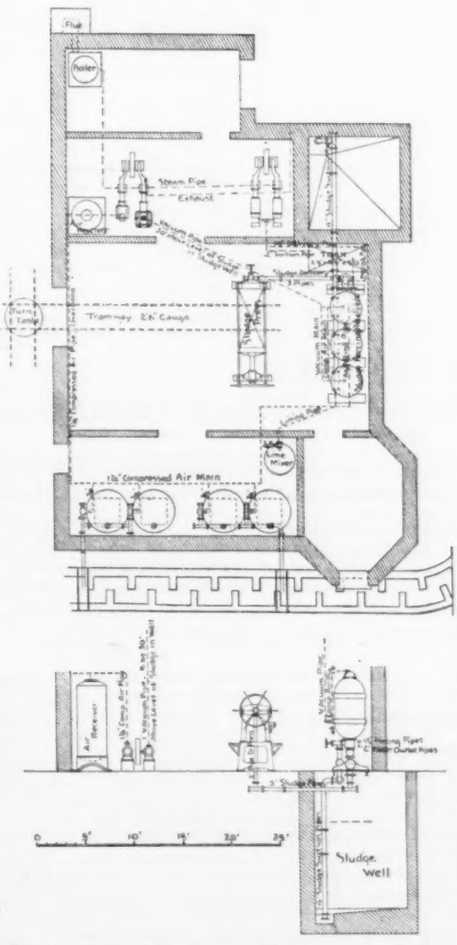
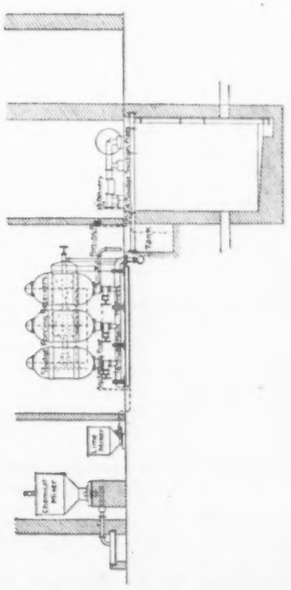


Fig. 3.—Plan and Sectional Elevations of Building Containing Sewage Disposal Plant.

extending lengthwise. Each set is composed of three chambers measuring 35 ft. 1½ in. in length by 36 ft. in width. The lower end of the salmon ladder terminates in two circular openings 24 ins. in diameter, and provided with slide valves so that the flow may be admitted to either set of tanks, one of which is precipitating and being emptied while the other is filling. The sewage falls into a tank 12 ft. square, one side of which is formed by a floating board which, rising as the tank fills, prevents, the too violent agitation of the contents of the first chamber in the corner of which the small tank is situated. The first tank having become filled, the sewage flows over the dividing wall into the second and so on to the third. The water is then siphoned out through pipes provided with floating arms in the ends of which are charcoal filters. The effluent flows over white tiling in order that its condition may be observed and then enters a surface carrier leading to the filter beds, which will be described later. The floors of the tanks slope toward the center. As the first tank receives a greater part of the deposited matter than either of the others, they are cleaned in this order: the first one, then the first and second, then the first, second and third. The viscous fluid remaining, called sludge, consists of about 10 parts solid and 90 parts liquid. This then flows to the sludge well, from which it is raised to the sludge forcing receivers by atmospheric pressure, an exhaust pump connecting with the receivers. When the receivers, Fig. 3, are charged, the valves in the pipe leading from the well are closed, and those admitting compressed air opened. The air pressure forces the sludge to the press, which is formed of hollow iron cells lined with canvas which acts as a strainer. The liquid flowing from the press is conducted back to the tanks. As the sludge passes to the press it is mixed with lime.



The liquid from the tanks enters a brick surface carrier (indicated by the double lines in Fig. 5) 12 ins. deep and 24 ins. wide and provided with gates about 50 ft. apart, opening from each side. The flow then passes over the surface of the ground which is under-drained by ordinary drain tiles tending to a brook flowing along the western side of the grounds. The drawing clearly shows, in the single lines, the tiling. The intermittent system of filtration is followed. There is no disagreeable odor anywhere about the premises.

The building is constructed of blue trap rock, woven joints pointed in red mortar. The trimmings are of Pennsylvania blue stone.

The cost of the entire system was as follows: The building for the disposal works, $65,000; machinery, imported from England, $75,000; straightening and deepening brook, grounds, etc., $15,000; sewerage system proper $210,000; making the total cost about $300,000.

——THE CHAMPERICO & NORTHERN TRANSPORTATION Co's. railway, in Guatemala, runs from Champerico, on the Pacific coast, to Caballo Blanco and Retalhuen. It is 27½ miles, long, with 1 mile of side tracks; gauge, 3 ft.; maximum grade, 3 per cent.; minimum curvature, 24°; rails, steel, 35 lbs. per yd.; ties 6 x 7 ins. x 6 and 6½ ft.; there are 2,640 per mile, about 62¾ per cent. are of native wood and 37¼ per cent. of California red wood; bridges of steel with masonry abutments; buildings of iron and wood. There are 3 Baldwin engines, 2 of 28 tons and 1 of 22 tons. The majority of the rolling stock was built by Carter Bros., of Newark, Cal., and consists of 30 box cars (8 tons capacity); 10 flat cars (9 tons capacity), 5 of which were built at the shops; 3 passenger cars, 1st, 2d and 3rd class; 6 hand cars; 2 push cars and 2 velocipede cars. At Retalhuen there is a machine shop with iron and wood working tools, blacksmith shop and saw mill. There are 3 iron water tanks on the line. The concession was granted in 1881, a company was formed in California and work commenced in 1882, and the road was opened in 1884.

The Alignment of the Nepean Tunnel, New South Wales.

The Nepean tunnel is 23,5 07ft.,or 4.45 miles long. The bases at the east and west ends were 254 ft. and 212 ft. respectively, situated at the bottoms of precipitous gorges nearly 300 ft. in depth. There were six shafts admitting of only 12 ft. bases, the depths ranging from 210½ ft. to 324 ft. The tunnel is a conduit for water and was cut at once to the full section. The length between shafts Nos. 2 and 3 was 4,341 ft., the headings meeting at a point 3,018 ft. from shaft No. 2. The error in the alignment was ⅝ in., and in the levels ¼ in.

The tunnel is situated at the head of the works for supplying Sydney with water. The inlet taps the Nepean river immediately below its junction with the Cordeaux river at an elevation of 430 ft. above sea-level. The outlet of the tunnel opens onto the Cataract river, a few hundred feet below Broughton's Pass crossing. The tunnel is 7 ft. 6 ins. high from invert to crown, and 9 ft. 6 ins. wide at the broadest part, the normal cross sectional area being 57.84 sq.ft. The inclination is at the rate of 2 ft. 6 ins. per mile, and it is capable of discharging when running full, 97,000,000 galls. of water in twenty-four hours. Several streams cross the line of tunnel, but only one of importance, at 11,947 ft. from the inlet. The average elevation of the surface over the tunnel is 260 ft., attaining 425 ft. at Wonson's Hill, the highest point. The geological formation is Hawkesbury sandstone. A trial survey of the line was made in 1869, and when it was decided to carry out the Nepean scheme, a more detailed survey was entrusted to Mr. G. A. TILLETT to enable the contract plan and section to be issued. Before the contract was let, the author was requested to make an independent set of levels over the whole line. When compared, the sets of levels were found to differ by only ½ in. at the end of the line, but about the center the difference was 2½ ins. The two gentlemen above mentioned then went again over the ground together, working with separate instruments, and the differences were corrected.

The contract having been let to Mr. W. J. EDWARDS, the work of tunneling was commenced at both ends. In the first place the center line was again run with an 8-in. transit-theodolite, and points were established on posts sunk level with the surface, at every important place along the line; bases were also established temporarily in the bottoms of the gorges, to enable the tunnel to be correctly started. On the highest point at Wonson's Hill an observatory was built, which commanded the whole line. The foundation for the column for the instrument was of masonry, 5 ft. square, the surface of the stone being 3 ft. above the ground. Care was taken not to disturb the original center point, which was plumbed up through a circular hole in the stone, 1½ ft. in diameter, and marked on a brass plate leaded in at right angles to the line. A weather-board shelter, 12 ft. square was erected over the stone with doors opening in the direction of the line. The large transit instrument was made by Messrs. Troughton & Simms, of London.

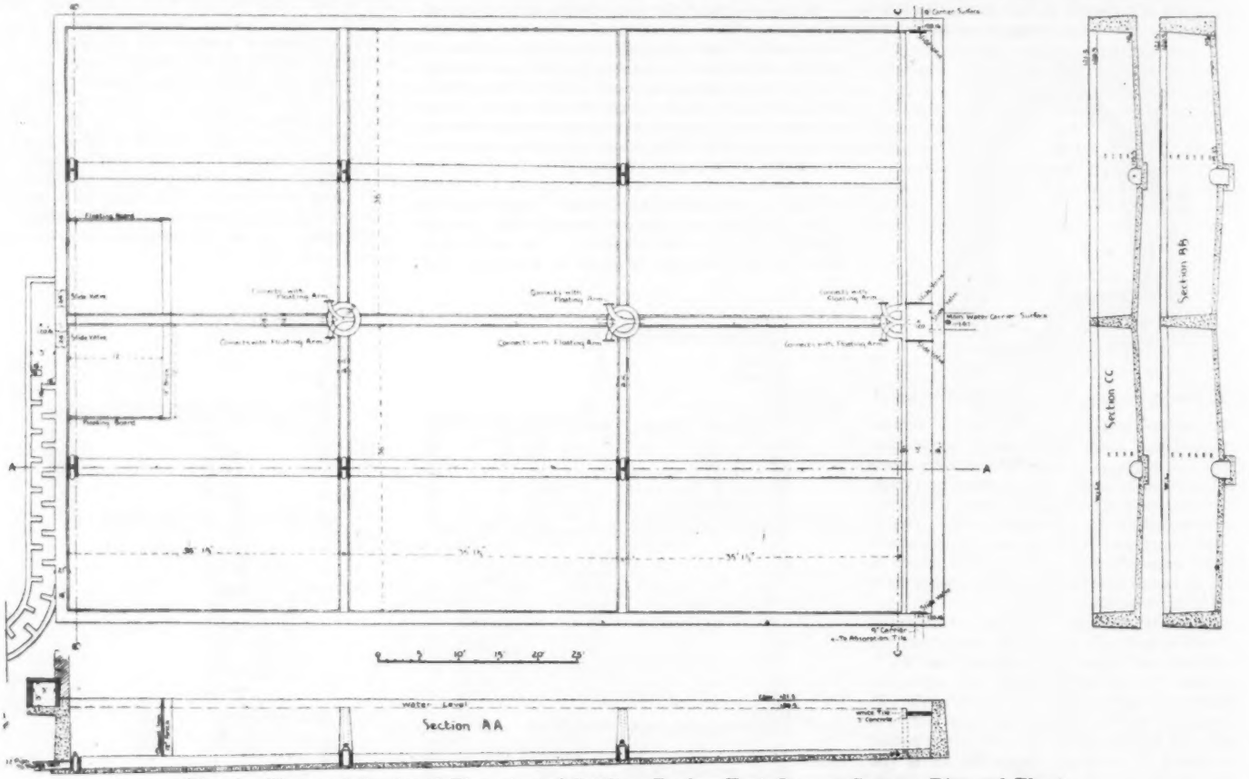


Fig. 4.—Plan and Sectional Elevation of Settling Tanks: East Orange Sewage Disposal Plant.

Another observatory was built of masonry set in cement mortar at the extremity of the line, across the Cataract river on the high ground about ½ mile beyond the gorge. It was nearly 4 miles from Wonson's Hill, and commanded all important stations on the summits of the hills along the line. The face of the pedestal for the transit-instrument was dressed smooth, and the center line painted on it with a black streak, 1 in. wide from top to bottom, on a white ground.

A rough timber-shelter, 8 ft. square and 8 ft. high was erected over the pedestal, the sides and roof being covered with galvanized iron, and doors were provided opening back and front 5 ft. wide. About 50 ft. to the rear of the observatory, a back-ground of boards painted white was erected, so that when sighting from any of the stations along the line, the object suspended over the center point on the stone should be clearly defined. All trees in the vicinity were cut down. At the side of the observatory, and also at Wonson's Hill, a semaphore was erected, consisting of a pole supporting a cross-bar with pulleys at each end for signaling purposes. After the pedestal was finished, the center point was transferred from the original mark on a rock a few feet

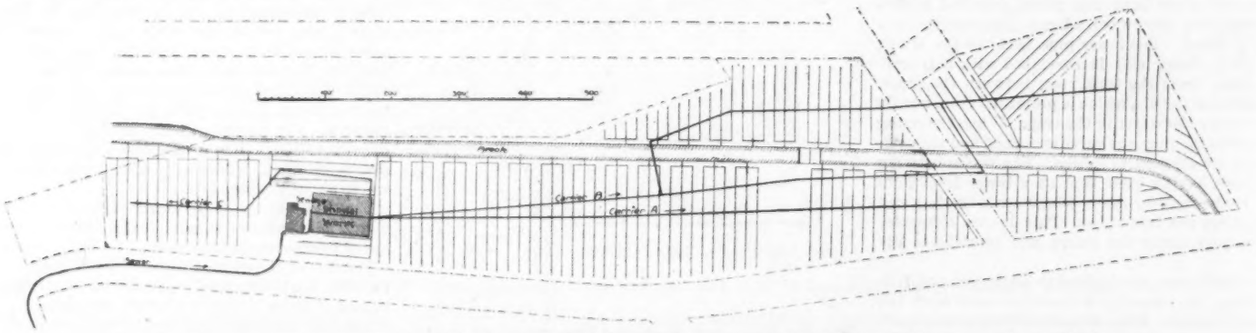


Fig 5.—Diagram Showing Surface Carrier and Underground Drains: East Orange Sewage Disposal Plant.

* Abstract of paper read before the Institution of Civil Engineers, by THOMAS WILLIAM KEELE, Assoc. M. Inst. C. E. From Selected Papers, Inst. C. E.

away, to a brass plate similar to the one at Wonson's Hill, let into the top stone. The plate, divided for a space of 3 ins. to 20ths of an inch, was securely leaded in at right angles to the line, and on this scale the particular division which corresponded with the center line was marked. Similar scales were invariably used throughout the whole work, both above and below ground, whenever it was necessary to establish a point by plumbing.

On the pedestals the scales were leaded in across the holes, and the plummet was hung inside, where it was protected from wind; and if required the hole could be filled with water to steady the bob. The plummet-wire or steel bar, being suspended from a sighting-frame or tripod, was brought into position while just touching the scale, and the reading could be taken accurately.

The points in the center line in the Cataract and Wonson's Hill observatories having been fixed, it becames necessary to produce this line to the Nepean river, nearly a mile distant. The large transit was therefore placed in position in the Wonson's Hill observatory, the telescope was directed to the Cataract observatory, and the intersection of its cross-wires brought into coincidence with the black line 12 ft. in length, painted on the face of that pier. The telescope was then lifted off the Ys, and a bar inserted in its place. This bar was provided with a collar at each end, turned to fit the Ys. A tiny hole was drilled through the center, and a fine silk thread was passed through the hole, and a small plummet attached to the end and lowered inside the pedestal: after it became steady, the position of the thread against the scale was noted, and if it was found to be off the permanent mark, the plate on which the standards rested was shifted till it coincided; the bar was then lifted off, and the telescope again adjusted on the Ys, till the black line on the distant pedestal was intersected, and so on through successive approximations. At length the telescope intersected the distant mark, and when replaced by the bar, the plummet-thread exactly cut the permanent mark on the brass scale; the instrument was then in adjustment to extend the line. The telescope was reversed and directed to a plummet-cord ⅛ in. in diameter, suspended from a sighting-frame on the top of a pedestal, built on the edge of the cliff over the inlet of the tunnel; this cord was clearly seen when a white background such as a handkerchief was held behind it. The cord having been carefully moved till it was intersected by the cross-wires, the scale reading was taken, the telescope lifted out of the Ys, and turned over, and the operation repeated, the mean of several such observations being adopted as the true point on the cliff pedestal.

The line having now been established at three important points, permanent marks were fixed at the bottoms of the gorges, to serve as bases for carrying on the underground work from the ends of the tunnel. Small pedestals of masonry were constructed in positions where the transit could be used; and the mean result of a number of careful observations having been obtained, the transit-instrument was taken to the pedestals at the bottom, on the opposite side of the river to the mouth of the tunnel.

The line was marked on brass scales, fixed in the rock just over the tunnel mouth, and a fine thread with plummet hung so as just to touch the scale; and the mean of a number of sights being taken, the line through these points from the point on the pedestal, formed a base which was produced into the tunnel.

The first contractor, Mr. EDWARDS, died on May 5, 1881, at which time he had driven 862 ft. of tunnel at the outlet end, and had sunk one shaft to grade. Owing to the river keeping high, the work at the inlet had been suspended some months before, and the open cut in front was all that had been done at that place. Between that time and the reletting of the contract, on July 29, to Messrs. TOPHAM, ANGUS and SMITH, preparations were made for carrying on the alignment from shafts, by the building of pedestals at suitable points along the line. Four of these were erected between Wonson's Hill and the Cataract river, similar to the one already described, but they did not need to be so high. Sets of observations were taken from the main observatories, and the center line was eventually established at all the intermediate pedestals.

A good time for observing was found to be in fine weather just before sunset; but a calm night was the best of all, the instument then remained very steady, and when large powerful lamps were used for signalling, the work could be carried on most satisfactorily. The best object for sighting at long distances at night, was a steel bar of a thickness depending on the length of sight, with a background of calico immediately behind it; if a strong light from a lamp with good reflector, was now cast upon the back of the screen, the bar showed out clearly and sharply. A magnesium-wire lamp was tried on one occasion for this purpose, but the light was uncertain, difficult to control and very expensive: and, in addition, inside the tunnel its fumes were an annoyance. Night observations on the surface above the tunnel were attended with serious inconvenience from the numerous fires of the miners camped along the line.

The bars for sighting were of steel truly straight, of diameters varying from ¼ to 1 in. and 6 ft. in length. All the bars were capable of being suspended from tripod legs of pine; and they were sharpened to a point at the bottom. Plummets of 10 or 12 lbs. weight, bored through their centers to receive the bars, were attached. At 4 miles the 1-inch bar was always used; at 1 mile the ¼-inch bar was sometimes found too thick, and a cord 1/16-in in diameter with a plummet was substituted. The bars were painted black, and a screen of calico was placed behind, but in day-work it was necessary to have the background some distance away from the observatory, to allow as much light as possible to enter through the doors.

The new contractors having determined to carry on the tunneling from shafts, in addition to the two ends, the sinking of three was immediately proceeded with, and subsequently two others were put down; and tunneling from the shaft sunk by the former contractor was at once commenced.

The ordinary method of transferring the line to the bottoms of the shafts by plumbing was adopted. At the shafts, from which long distances were expected to be driven, pedestals of masonry were erected, one on each side, on the center line of the tunnel, and about 50 ft. apart, the tops being level, and 1 ft. above the brace or platform: holes were drilled in them, and brass plates leaded across as previously described. Points on the center line were then accurately established on each from the nearest observatory. A steel wire, about 1/16 in. in diameter, was then strained at its utmost tension, as determined by a Salter's spring balance, from pedestal to pedestal, across the shaft, being made fast to posts at the ends, and adjusted to cover the particular division on each scale, which corresponded with the center line.

A calm morning was essential for this work. The wire having been placed in position on the line, the process of plumbing down the shaft was proceeded with. From the mouth, and up to 600 or 800 ft. in, it was sufficient to use silk, or hemp-fishing line, about 1/20 in. in diameter with an 8-lb. plummet.

As the headings increased in length, copper wire was sometimes used, but was liable to break. Steel piano-wire about 1/16 in. in diameter proved best, with a 56-lb. plummet of cast-iron truly turned; this wire was suspended from a tripod, placed across the horizontal wire, and standing on the platform of the shaft, through which a hole was cut to allow it to pass; the tripod was provided with an apparatus, by which the plummet could be raised or lowered to its proper position, and, by screw adjustments, the pendent wire could be brought just to touch the horizontal wire strained across the pedestals.

An assistant at the bottom of the shaft placed the plummet in a vessel containing water, and gave the necessary directions through a speaking tube to the observer on top, to cause the wire to almost touch a brass scale screwed on to a beam of timber, fixed into the rock over the crown of the tunnel. In about half an hour the heavy plummet became steady, and the reading on the scale was noted. As it was desirable to obtain the longest base possible in the shaft, the plummets were hung as close as possible to the sides without touching anywhere. After the wire had been brought into position, and before the scale reading was taken, it was carefully examined from top to bottom with a candle, the observer going down very slowly in the cage. After this no one but the observer was allowed on the platform, and the pumping, blowing, and hoisting engines were stopped; even the observer himself did not move from the position selected for noting the coincidence of the vertical and horizontal wires, as the least movement about the platform caused vibration in the vertical wire. The horizontal wire during the interval was watched, to see that it did not shift off the marks. The center point on each scale at the bottom of a shaft having been thus established, the heavy plummet was removed, and the steel wire drawn up; fine cotton or silk threads were then substituted, with plummets of sufficient weight in water, suspended from the scales, and adjusted to the marks. An 8-in. transit theodolite on its centering legs was then set up a short distance from the plummets, in one of the headings, and the intersection of its cross wires brought into coincidence with the line as given by them. The striding level was always used during the operation, to adjust the horizontality of the axis, and the focusing screw was always turned the same way, and never reversed; when these precautions were taken, and with a little practice, very accurate results were obtained. After the instrument had been adjusted to prolong the line into the heading, a hole was drilled in the roof some distance in, and a wooden plug inserted; the point was then obtained on this plug, by sighting on to a plummet lamp suspended from it, and the mean of several observations, reversing each time, was taken as a true point in the line. Horse-shoe nails hammered flat at the top, with a small hole bored through, were found best to suspend the plummet lamp from, as the metal bends readily when tapped on one side or the the other without breaking. When the headings were driven over 1,000 ft., the plummet lamp was suspended by a string from a brass scale, in a beam of timber fixed in the crown of the tunnel. For signalling, large railway semaphore lamps were used, showing red, green and white lights; when the tunnel was clear of smoke, these were visible about 2,000 ft. away.

As no marks in the shafts or tunnel could be depended on to remain for any length of time without shifting, repetition in these, as in all other cases in tunnel alignment, was invariably relied on to eliminate error, and no single set of observations was trusted for driving the tunnel any considerable distance. Before the headings were driven 1,500 ft. from a shaft, the whole operation of transferring the alignment below into the tunnel was repeated, independently of any previous work; even the points on the scales of the pedestals at the top of the shaft were checked with the transit from the nearest observatory.

The levels in the tunnel were given in the following manner: The value of a bench-mark at the bottom of a shaft having been ascertained, by measuring the calculated distance with a steel tape from the surface, the levels were run into the headings, and at intervals of 100 ft., hooks in pegs in the sides of the tunnel, and opposite to each other at right angles to the line, were so adjusted that strings passed through them and hauled tight, were exactly 2 ft. 9 ins. above the grade.

The plummet lamps, hanging from the center pegs in the roof, being then lowered till their lights were even with the horizontal strings, the axis of the tunnel was determined, and the miners were provided with both line and grade; all they required to do was to place a candle at the face in line with the lights from the plummet lamps, and measure down 2 ft. 9 ins., to find the grade of the invert. Bench-marks were established at intervals of 400 or 500 ft., and were frequently checked.

The plummet lamps were manufactured after the design of an American mining engineer, Mr. ECKLEY B. COXE; they were of brass, shaped like an ordinary plummet, and were hollow to contain oil; they swung in gimbal rings, suspended by chains from a hook, consequently the point of suspension and the center of the lamp-flame were always truly vertical. These lamps were found indispensable where great accuracy was required, and the flame, though only about ⅛ in. high, and about 1/16 in. in diameter, could be seen distinctly through the telescope at very long distances when the headings were clear.

The lengths of the headings, and the results of the alignment when the junctions were effected, are given in the following table:

Name of Heading.	Length in Feet.	Date of Commencement.	Date when Headings met.	Error In Line in ins.	Error In Grade in ins.
Inlet	2,054 0	June 10, 1881	Aug. 16, 1884	3	0-1
No. 5 { West	1,513 25	Feb. 25, 1883	Jan. 25, 1884	3	No error
No. 5 { East	935 0	" 25, 1883			
No. 4 { West	1,970 0	Jan. 13, 1882	June 28, 1884	3-8	1-16
No. 4 { East	2,408 0	" 13, 1882			
A { West	425 0	Jan. 26, 1884	Aug. 11, 1884	3-8	1-8
A { East	496 0	" 26, 1884			
No. 3 { West	1,359 0	Jan. 20, 1883	July 28, 1884	5-8	1-4
No. 3 { East	1,223 42	Jan. 20, 1883			
No. 2 { West	3,018 0	Nov. 18, 1881	Aug. 11, 1884	-8	1-4
No. 2 { East	2,385 0	" 25, 1881			
No. 1 { West	2,296 0	Sept. 5, 1881	Sept. 23, 1882	2,3-4	1-10
No. 1 { East	1,130 58	" 5, 1881			
Outlet	2,148 0	Feb. 9, 1880			

The first junction occurred when the headings from the outlet and No. 1 shaft met.

The base of 3,274 ft. from the mouth to the shaft was then produced into the west heading; this was the only case where advantage was taken of a junction to obtain a longer base. In every other instance the alignment depended entirely on the production of the 12-ft. shaft bases.

After the tunnel had been pierced through, cleaned and all timber removed, daylight at one end was distinctly seen without the aid of a telescope from the other, 4½ miles away.

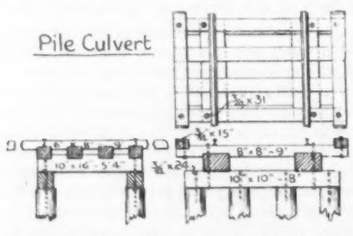
Rap'd Transit in Kansas City.

The following figures show the length, in double track, of the different street railways in operation:

Cable Lines.	*Miles.*
Eighteenth St.	3.38
Twelfth St.	4.21
Peoples'— Tenth and Broadway	3.56
Westport	2.84
Fifteenth St	2.72
Main line, Grand Ave. and Wainut St.	1.32
Ninth St. main line	2.74
Frost Ave.	2.66
East Ninth	.55
Independence Ave.	.76
West Fifth St	2.66
East Fifth St.	1.66
Riverview.	1.86
Tunnel	.75
	31.32
Motor Lines.	
There are five lines, aggregating	20.50
Horse Car Lines.	
There are six lines, aggregating	11.05
Total in operation	62.77
As generally estimated, single track	124.54
The six proposed cable lines aggregate	13.32

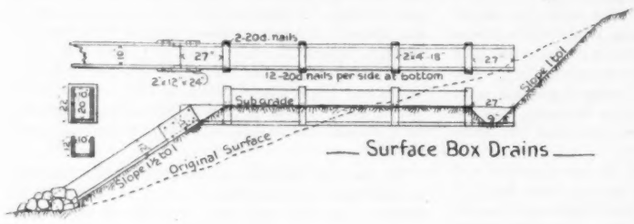
Standard Pile Culvert, Oregon Pacific Railway.

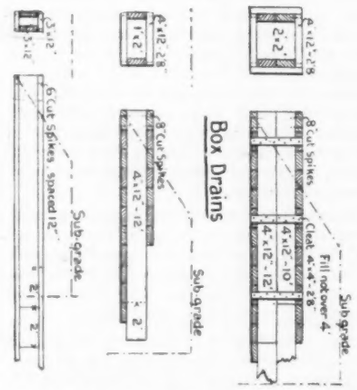
This style of open culvert is the only one used on the Oregon Pacific, box culverts being used in preference where the depth of fill is such as to permit of it. The culvert is one of very common design, but we cannot altogether commend it. The danger



Standard Pile Culvert; Oregon Pacific Railway.

to a derailed car from it is as great as if it were the beginning of a trestle a mile long, since it is the *entrance* to such a structure that is dangerous to wheels off the track, if it be provided with guard-rails. The most perfect protection in such a case is the Latimer re-railing safety guard; but if a man will not use that, he would at least not hesitate to spend a dollar or two, to give the wheels a better chance to get fairly onto and over the structure. With these small structures this is easily done, since it is only necessary to spread the piles a little more, and lengthen the caps and ties 3 or 4 ft. each. A derailed car then has as fair a chance to pass the





Standard Box Drains, Oregon Pacific Railway.

culvert as it has to pass any other part of the roadbed; otherwise not.

Standard Box Drains.

The accompanying drawings of one set of minor standards of the Oregon Pacific Railway speak for themselves, and require little comment. The trough carrying the drainage entirely clear of the artificial earth surface and the filling of rock at the end are too often omitted; and the smallest size of box drain shown seems rather small to be covered at all. The maximum admissible fill has been engraved for only one of the box drains, but it decreases regularly, being 4 ft., 3 ft. and 2 ft. respectively.

Duty Trials of Pumping Engines.

The following is an abstract of a paper entering a plea for a standard method of conducting duty trials, by GEO. H. BARNES, M. E., read before the Boston Society of Civil Engineers, Jan. 16, 1889.

No class of steam engines require their economy to be tested so frequently as pumping engines for water works. Nearly every engine of this kind which is built, goes into the hands of the purchasers with the builders guarantee that it shall do its work in accordance with a certain specified duty. Every engine thus guaranteed is generally made the subject of a duty test, before the builder receives the full payment of his bill. The test is conducted either by a representative of the builder or by the civil engineers under whose direction the water-works have been constructed, or by the superintendent of the pumping station, or by his engineer, or, in rare instances, by an expert or a board of experts appointed by the purchaser of the engine, or by a board representing both parties.

When the contract between the builder and the purchaser has been framed with a suitable degree of foresight, which rarely happens, the method of conducting and working out the result of the test is laid down as a part of the contract, and the person conducting the test has simply to follow the terms which it specifies. In the majority of cases the purchaser knows so little about the subject of duty trials, that he cannot on his part exercise much foresight in the framing of the contract, and the matter of the stipulations as to the duty tests are left to the builder. The builder's interest is to express the guarantee in such general language that in case of dispute as to the result, he may be secure from failure. It follows that in most duty trials the person who conducts the test is neither governed nor hampered by distinct specifications of the contract, and he may employ any method which suits his individual judgment or whim. No standard method has been established by any common consent, and the few cases which may be used as precedents are not applicable to the individual requirements of special engines.

It is not surprising, therefore, that a great variety of practice exists as to duty tests, and this variety covers the whole field beginning with the definition of the term "duty", which determines what the main quantities are, which it is the object of the test to ascertain, and ending with the manner of making the observations by which the necessary data are obtained. Examination of various pumping engine contracts and reports of tests made under them, shows the following state of affairs: One person holds that the term "duty" means the number of pounds of water elevated 1 ft. by 100 lbs. of coal, the water being actually measured. Another holds that it is the number of pounds of water elevated 1 ft. plus the quantity of work which is equivalent to the friction of the force main, using the same unit of 100 lbs. of coal. Another holds that it is the quantity of water, as determined by plunger displacement, elevated 1 ft. either with or without allowance for friction of force main, the basis being 100 lbs. of coal. Still another claims that it is the number of foot-pounds of work done as measured by the indicator diagram taken from the pump end of the engine, on the 100 lb. basis; and others adopt various allowances in the matter of slip or loss of action and friction of suction pipe and pump valves; while still others base the duty on the quantity of combustible instead of the quantity of coal consumed. One class of tests is based on the stipulation of 100 lbs. of coal, assuming that the coal gives a certain evaporative performance, in which case the duty is practically reduced to the work done by a given quantity of steam. Sometimes this quantity is expressed as water pumped into the boiler by the feed pump, irrespective of the quality of the steam into which it is generated, and without taking into account the condensed water returned independently from the jackets of the engine, or from other sources. Sometimes it is expressed as "water from and at 212°," in which case the temperature of the feed water enters the problem. Sometimes the quantity of steam on which the duty is based is that of dry steam or of steam containing not over a stipulated percentage of moisture, and sometimes it is the steam used by the steam cylinders of the pumping engine apart from that used by any of the accessories of the engine, such as jackets, air pump of condenser, feed pump of jacket water, and main feed pump of boiler.

The variations of results which these differences of practice produce are important. The friction of a force main often increases the work done as much as 10 per cent. The difference between the quantity of water delivered and that measured by plunger displacement is frequently 5 per cent. The percentage of ash in coal varies from 5 to 15 or even 20 per cent. The moisture in steam may be from 3 per cent. up; the quantity of steam condensed in jackets is from 5 to 10 per cent. of the whole; that used by the donkey feed pump varies from 3 to 5 per cent. of that used by the main engine. When an independent air pump is employed, the consumption of steam is increased some 10 per cent. The difference in economy produced by an evaporation from and at 212 degrees, and the observed evaporation, when the feed water is not heated above 100 degrees, is not less than 15 per cent. In a known case of dispute, a variation in the number of foot-pounds of work done by 100 lbs. of coal amounting to the excessive figure of 56,000,000 ft. lbs., arose between the method pursued by a responsible builder and that pursued

by the purchaser, though based on the same contract.

In determining a standard form for tests, the engine's economy is measured by the amount of duty realized, which term should be defined more strictly than is now the case, with its present elastic meaning. The form adopted should be applicable to every pumping engine, or at least to a large majority of such engines. The unit "100 lbs. of coal" is exceedingly variable. In the Eastern States it may be Cumberland coal which evaporates 12 lbs. of water from and at 212 degrees per lb. of combustible, or anthracite coal, which evaporates not more than 11 lbs. In the Middle and Western States, it may be Pittsburg, Indiana or Ohio coal of still lower evaporative value. The unit "100 lbs. of coal, assuming an evaporation of 10 lbs. of water per lb. of coal" is also variable, according to the temperature of the feed water and pressure of steam and according as allowances are made for moisture in the steam and for steam used by the jackets, feed pump and other accessories. The desirability of discarding the coal measure of economy, altogether, and expressing the performance of the engine in terms of the quantity of steam consumed, is recognized in cases, which are becoming common, when the contract provides that the boiler shall evaporate a certain amount of water per pound of coal. The steam unit is free from the objectionable features of the coal measure but must be used with a qualification The use of a feed water heater by which, in comparing two otherwise comparable tests, one boiler should save about 10 per cent. of the steam which does not appear in the duty calculation, renders the steam unit unfit except in certain cases where conditions are the same.

The heat unit is independent of the kind of coal or of the efficiency with which the steam is generated, varying with the quantity of steam consumed, and may be considered as the only true basis upon which to express the performance of a pumping engine. According to good practice the quantity of heat, which one pound of coal supplies at 11.25 lbs. evaporated from and at 212° is $11.25 \times 966 = 10{,}867$ *H. U.*, or in round figures 10,000 heat units, and the unit for 100 lbs. of coal may be taken at 1,000,000 *H. U.* This unit is recommended for adoption for a unit upon which to calculate the duty, and does not differ radically from results obtained if calculated upon the basis of 100 lbs. of coal. This view of the matter is supported by the opinion and latest practice of the experts of Europe, who base the performance of steam engines on the number of thermal units of heat consumed.

In using the unit proposed, its application is to be made not only to the heat consumed by the engine proper but to that consumed by all accessory parts of the engine, such as steam pumps, (including donkey pump), jackets and all apparatus necessary to the operation of the engine, the computation being made upon the whole heat thus consumed.

The other element to be considered is the expression to be employed for the quantity of work done. The work consists of two factors, the number of pounds of water pumped, and the number of feet in elevation to which the water is raised.

In determining the first named factor, which is the only one which involves any difficulty, there are two methods, (1) the use of either the standpipes or the reservoirs for the purpose of a measuring tank, or (2), the use of a weir. The first is objectionable because the result can only be approximate. The second can only be applied where a reservoir exists, and is therefore limited in application. These objections render it impracticable to use any form of direct measurement for a standard. The only means by which the water can be measured, which is of ready application, is the indirect but simple method in common use, furnished by computing the plunger displacement and using the pump itself as a motor. The principle objection lies in the "slip", which is made up of the three quantities: leakage of plunger and valves, loss of action of the valves, and the presence of air mingled with the water, and which causes the actual discharge from the pump to be less than the calculated discharge based on this method. The best standard, therefore, for the quantity of water pumped, is that determined from plunger displacement, corrected for leakage of the plunger, and for loss from the introduction of air into the pump, should it be found that these losses exist. It is quite generally recognized that in computing the quantity of work done, no allowance should be made for friction of the water in passing through the passages and valves in the pump, while, on the contrary, allowance should be made for the friction of the force and suction mains, the principle being that the efficiency of the engine should not be made dependent upon any condition foreign to itself.

In accordance with the above views, the duty of all engines would be expressed by the following formula:

$$Duty = \frac{\text{Ft. lbs. work done}}{\text{Thr. units of heat consumed}} \times 1{,}000{,}000$$

$$= \frac{(C \vee W N - L)\ (H + S + h)\ 1{,}000{,}000}{\text{Thr. units of heat consumed}},$$

in which V = volume of piston displacement, one stroke, cu. ft.; W = weight of one cu. ft. of water; N = number of strokes during trial: H = head in feet corresponding to indication of pressure gauge on force mains, h = head in feet corresponding to indication of gauge on suction main (minus when there is a head of water in suction main); S = vertical distance in feet between the two gauges; L = leakage of plunger; C = correction for loss produced by air discharged with the water.

The units of heat consumed = weight of water supplied to boiler by main feed pump by total heat of steam of boiler pressure above temperature of main feed water plus weight of water supplied by jacket pump by total heat of steam of boiler pressure above temperature of jacket water plus weight of any other water supplied by total heat above its temperature of supply.

To cover the foregoing requirements in the framing of a contract, the guarantee as to the performance of a complete plant may be expressed in the following terms: "The engine shall perform a duty equivalent to not less than (*A*) foot-pounds of work for each 1,000,000 thermal units of heat consumed, and the difference between the actual delivery by weir measurement and that calculated from plunger displacement shall not exceed (B) per cent. Furthermore, the boiler shall supply 1,000,000 thermal units of heat to the engine on a consumption of (*C*) pounds of (*D*) coal. The duty trial is to be conducted, and the results computed in accordance with the standard method of conducting duty trials, determined upon by "(the authority named)."

TO BE CONTINUED.

Preserving Exposed Ironwork.

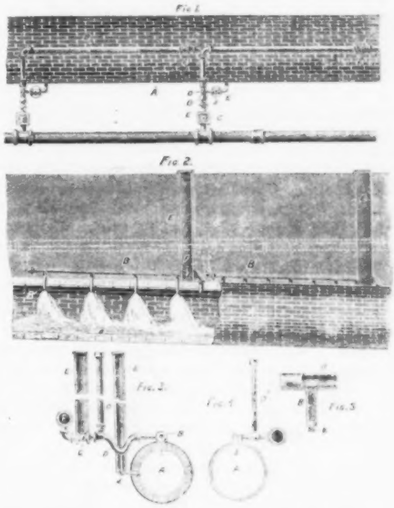
A recent issue of *Industry*, of San Francisco, Cal., contains the following: JOHN HEALD, the proprietor of the machine works at Crockett, Contra Costa County, has for some years past been experimenting with a view to preserving exposed ironwork, and has demonstrated some things respecting this important matter that may be of great value. Mr. HEALD, some years ago, had occasion to move a gas holder at Vallejo, and happened to notice on the old plates, which were badly corroded, that the "shipping marks" on the sheets were perfectly preserved. This led to the examination of other cases of the kind where marking had been done on ironwork, and also to experimenting with turpentine and white lead as a first coating to prevent rust. It is found that when surfaces are coated with finely ground lead thinned with spirits of turpentine, no corrosive action or scaling takes place, even when heavy coats of paint are afterward put on the outside. Mr. HEALD says that common paint mixed with oil is too thick to penetrate or close the imperfections of the surface and penetrate beneath the scale where it exists, thus leaving places for corrosion to begin beneath the paint. With turpentine and white lead mixed thin, the very pores of the iron are closed. The interstices, to so call them, are too minute to receive the body which oil gives, but are closed by the thinner compound. This is the theory, but that is a matter of no consequence so long as the fact is known. The wash can be quickly put on, and will dry in a short time.

——THE FORTH BRIDGE, it is now said, will probably be completed in October, 1889, but it is not expected that the bridge will be opened for traffic before December next, or possibly not till the spring of 1890.

The Galvin Sewer Flusher.

This is a device for flushing sewers by water jets and it is claimed to be simple and efficient. The sections and plan given explain the general appearance of the apparatus. In Fig. 3—*A* is the sewer; *B*, flushing tank; *C*, water supply valve; *D*, test pipe; *E*, valve boxes; *F*, water main, and *d* is the valve from the trap,

In operation, water is admitted from the main by



opening the valve *C*. A 1-in. pipe *B*, fitted with 25 ⅛-in. sprays, 2 ft. apart, will thoroughly scour out 50 ft. of 18-in. sewer. By opening the valve *d*, the contents of the water seal are emptied into the sewer, and a direct communicotion is afforded through which the sewer may be examined from the surface. Any further information concerning this flushing device will be furnished by the makers, the Galvin Valve and Hydrant Co., Detroit, Mich.

The Artesian Well Water of Atlanta, Ga.

The prevailing opinion that water from an artesian well must necessarily be pure, as far as albuminoid ammonia and chloride of sodium are concerned, is somewhat overturned by the official report of the board of health of Atlanta, Ga., as reported in the *Constitution* of that city. They say that the artesian water there is impure, and found their declaration upon the analysis of Mr. MCCANDLESS and Professors WHITE and GASCOYNE. The report of these experts, covering a period from 1886 to November, 1888, is as follows for 5 samples:

Sample	Grains per U. S. Gallon.		Parts per million.	
	Total solids.	Sodium Chloride	Free Ammonia.	Albuminoid Ammonia.
9	10.07	2.09	0.01	0.01
11	21.00	8.35	0.01	0.04
39	23.35	10.56	0.02	0.04
40	18.30	11.36	0.04	0 08
41	23.50	11.79	0.02	0.06

The report states that this well was bored to a depth of 2,044 ft., and is supplied by four veins of water at 102, 450 and 1,160 ft. respectively from the surface. The well is said to be securely plugged at a depth of 1,169 ft. or just below the largest and deepest vein. This lower vein supplies 90 per cent. of all the water in the well.

The analyses given above show a large proportion of chloride of sodium and an excess of solids. The quantity found of the sodium chloride is not necessarily a radical objection to the water; but its presence suggests the possibility of sewerage contamination, and is a suspicious indication. The rapid increase in this ingredient, from 8 to 11 grains per gallon in 2 years, is the notable fact, especially when taken in connection with the further fact that the smallest amount is found after an exhaustive pumping of the well.

The possible source of this salt in well water, says the report, are deposits, strata or beds of chloride in the earth, through which the subterranean streams flow or percolate: the presence of passages or crevices which communicate with polluted streams, possibly at a considerable distance from the point of exit, and which convey the foul water, but little or not at all changed into the well; or the presence of surface water, which has passed through a soil in the immediate vicinity of the well, saturated with sewage. The term "sewage" in this case meaning all forms of waste, offal, refuse, whether it be collected in drains or left upon the ground.

Sea water or salt springs water will show, of course, the presence of a great deal of sodium chloride, and no surprise would be excited by this discovery, nor would there be any suspicion of sewage. Favorably located wells about Atlanta indicate the presence of chloride of sodium in quantities ranging from half a grain to three grains per gallon, while in unfavorable localities this sometimes runs as high as 25 or 30 grains. Wells with as much as 16 grains have always been condemned by the Board of Health and the use of the water prohibited.

The only reasonable explanation of the presence of the chlorine in this artesian water is, continues the report, that this water is, partly, at least, surface water, which has been in contact with sewage. The fact that after exhaustive pumping to test the capacity of the well, the sodium chloride was found in the proportion of 2.09 grains per gallon, goes to prove that the main source of supply does not contain the offending matter, but that the polluted water enters the well from some minor source, and is practically overcome by vigorous drafts upon the total flow.

The expert furnish a key to the problem, however, in the following passage of the report:

"With a 6-inch iron pipe extending 200 ft. only, within a bored well, 8 ins. in diameter and 1,160 ft. deep, what will prevent surface water freely flowing into the well?" asks the board. "It will not do to say that the 8-in. iron pipe driven into the granite at a depth of 81 ft. below the surface, will or can shut out all the shallow streams? It will not do to claim that the granite itself shuts out all surface water. Shall we ignore the presence in granite formations of seams, crevices, cracks and fissures. Reluctant as we are to dispel the fond illusions of our fellow citizens, the board is constrained by a sense of its duty to express officially the conviction, based upon the evidence before us, that the artesian well is a palpable failure. It may be that the use of the water is even now attended with some risk, and we fear it bids fair to become more and more polluted, and in the near future unless great amendment is secured, that it will prove fatally defective. And while the board is not prepared to condemn without qualification the use of this water, it desires to go on record as declaring the water impure and of doubtful safety for drinking purposes."

This portion of the report closes with the recommendation that the extension of the water mains be discontinued, especially where they are parallel to the mains of vastly superior and absolutely unexceptionable water, and that the water be tested by repeated analyses; that at the same time the pumps be worked to their fullest capacity for several hours, as in this way tests may show the vein or veins by which the polluted water enter the well. It may be found feasible to shut off such as are found objectionable.

STEEL RAILWAY COACHES.—Some new fireproof steel cars have been just completed for the Louisville, New Albany & Chicago Railway. The car is in all respects a first-class coach, the only difference being that steel is substituted for wood in the construction. Above the trucks all is non-combustible material, and consists of the usual number of sills and girders, faced with steel plates set on edge, through which and extending across the car are heavy steel bolts firmly secured. On these, studs with shoulders against each sill, have been placed. The frame-work of the car is attached to these sills, the ribs and post along with the raised deck being bent without heat to the required curve. Steel sheets cover the framework, making it comfortable both in winter and summer as well as absolutely fireproof. Lightness, strength, durability, and resistance to fire, it is claimed have been obtained. The New Albany road will soon put some of these cars in regular service.

ENGINEERING NEWS.

——BOSTON CAPITALISTS are reported as having lost nearly $40,000,000 in capital and $3,000,000 in dividends in one year by the shrinkage in values of Atchison, Topeka, Santa Fè and Chicago, Burlington & Quincy railroad stocks, which are both distinctly Boston concerns.

——STREET RAILWAY AND GAS WORKS are said to be projected for the ancient city of Damascus, and the necessary concessions have already been obtained. The people are enthusiastic over the innovations, which they believe will tend to enhance the value of real estate within the city's limits. The population is about 150,000.

——THE MATURIN RAILWAY CO. has been incorporated in England to build a railway in Venezuela, from Maturin, in the State of Bermudez, to a point at which the river Caño Colorado is navigable. A concession was granted in July, 1888, for this road.

——THE ELECTRIC PROCESS FOR REFINING SUGAR, about which such a stir was made a few months ago, and which was described in ENGINEERING NEWS, Sept. 22, 1888, is now reported to be a fraud. The Electric Sugar Refining Co. was organized to operate a process invented by Prof. HENRY C. FREIND, which process was kept secret; it was claimed that raw sugar was turned directly into refined sugar, but it now appears that the raw sugar for the tests was merely stored away and refined sugar run through the machinery. The product is said to be finer than that made by any known process, but it is too expensive. The deception consisted in manipulating refined sugar, instead of refining sugar by a new process.

——A SCHOOL OF ELECTRICAL ENGINEERING is to be established in Columbia College. It will be a post-graduate department and commence in a small way to test the popularity of such a branch of instruction.

——The NEW CRUISER *Vesuvius*, built by Cramp & Sons, Philadelphia, Pa., made on its first trial trip, Jan. 11, the wonderful and unprecedented speed of 22.947 knots per hour with wind and tide and 20.346 knots per hour against it, an average of 21.646 knots or 24,915 statute miles per hour. The highest speed on record heretofore, if we are not mistaken, is 20.6 knots for the Spanish cruiser *Reina Regente*, of 4,800 tons and 12,000 H. P. Fuller details of this remarkable performance are given elsewhere. The only men living whose past achievements give any ground for confidence that they can beat this record are the HERRESHOFFS, of Bristol, R. I., who will perhaps now be heard from; 23 knots is called for on a fast torpedo boat now building.

——A DOUBLE PUNCHING MACHINE of unusual weight and power has just been completed by Messrs. JAMES RENNIE & SONS, of Clyde Engine Works, Glasgow, for an English firm of ship builders. It is of the lever and cam type, now in so common use in ship building yards, etc., and besides having a steam engine for driving it is provided with two very strong cranes, having arms long enough to deal with plates 27 ft. long and capable of carrying plates up to two tons in weight.

——THE BRITISH LOCOMOTIVE BUILDING TRADE is now in better condition than it has been for some time back. The principal firms were all fairly busy during the latter part of 1888, and the outlook for 1889 is regarded as encouraging. It is a small interest, however, compared with American locomotive building. Most of the leading English companies build their own engines.

——IN spite of Russian petroleum fields, petroleum is not growing cheaper, although the volume of our exports is slightly less this year than last. The export figures stand:

	Million galls.	Value.
Exports 1888.....	546.73	$45,969,000
" 1887.....	581.02	45,231,988

Cotton exports were likewise a shade less this year than last, but of slightly greater aggregate value.

——THE NEW STEEL POSTAL CAR, which has been in course of construction at the railway shops in New Albany for the past two months, is about completed. The car is the first of the kind ever constructed. It is said that it can be constructed for fully 25 per cent. less money than the old coach, will not weigh so much by 20 per cent., and is absolutely indestructible from fire. It is built of plates of steel, lined with asbestos, and is admirably braced by means of steel rods running the entire length of the car, the rods being fastened by an ingenious device into the steel posts. The floors are of steel, as are the platforms and steps, and there is no wood whatever about the car except the timbers of the trucks. The car is being built by the American Fire-Proof Steel Car Co., of Chicago, under the especial superintendence of J. C. BAILEY, Superintendent of the company, and W. W. GREEN, the inventor. Should the car prove to be successful, the company will erect a plant at Decatur, Ala., and go into the manufacture of steel passenger coaches on a large scale.

——AN ANGLO-CANADIAN CABLE is proposed, based on a prospectus of 1839. Mother England evidently sees a necessity for all the apron-strings possible, to keep her independent and growing colony from getting away altogether.

——TILE DRAINAGE is interesting the New Orleans public, and is an essential feature in the new drainage project of Mr. HARROD. The saturated soil and low-level of that city forbids underground drainage as usually resorted to. In the past, and present for that matter, open gutters and a soil saturated with filth and water to within a foot or two of the surface has been the rule, with all the unsanitary conditions this state of things implies. With the new scheme, which proposes to drain by pumping all of the upper 6 ft. of soil, the tile-drain has a special field of usefulness in assisting in this work, and the result should be a most decided improvement in ridding the city of prevailing diseases incidental to foul subsoil.

——THE READING R. R. ELEVATED ROAD, in Philadelphia, is so far perfected in plan that it is acceptable to President Corbin and to the Committee of City Councils, and a new ordinance is now before the latter body. The new plan is made up of concessions from both the city and the railroad company. All the city gives is the right-of-way, but it permits the surface tracks to remain north of Green St. In consideration of this privilege, the company augments its elevated tracks to such an extent that the cost is increased from $7,000,000 to about $14,000,000. The use of the surface tracks is limited by iron-bound restrictions as to hours, etc. Three years would be required for the completion of the road.

——THE MERCHANT'S BRIDGE, at St. Louis, over the Mississippi river, has been let to the Union Bridge Co., of New York, work to begin Feb. 3 next. The Union Bridge Co.'s bid of $1,250,000 covers the piers and superstructure, but the caisson work is let to the firm of Anderson & Barr, of Jersey City, which firm has already taken steps to commence operations. These are the same two firms which together so successfully completed the Hawkesbury bridge, and are now about finishing the Cairo bridge over the Ohio river.

——THE COST OF ELECTRIC LIGHTING has been the subject of investigation by Prof. ELY, of Johns Hopkins University. His correspondence with city officials shows a movement towards municipal ownership of electric lighting plant. The actual cost of running the municipal works of Dunkirk, N. Y., for the month of October, 1888, is given by the mayor of that city as follows:—Average number of lights run during month 55 arc lights. Amount of coal consumed, 137,777 lbs., at $1.65 per ton, $113.55; number of carbons used, 3,412, at $11 per thousand, $38.28; 6 galls. cylinder oil used, at 90 cts., $5.40; 5 galls. lubricating oil used, 35 cts., $1.75; six globes used, $1, $6, ten carbon holders used, 25 cts., $2.50; six brushes used, $1, $6; 20 pounds of waste, 9 cts., $1.80; amount paid for labor, $50; total cost for October, $225.28; total hours run, 364 1-6; total cost of running 55 arc lights 364 1-6 hours, $225.28; total cost of running 55 arc lights one hour, 62 cts.; total cost of running one arc light one hour, 1⅛ cts. As the mayor of the city says, the cost of each arc light per night, running all night and every night is 13½ cts. The capacity of the arc light is 2,000 candle power. The system used is the Western Electric of Chicago. The total cost of plant and building was $13,338. The city also owns and operates its water plant, and a great saving has been effected by running the two in conjunction. The same engineers, firemen and superintendent operate both, and the same boiler power is used. The superintendent believes that the cost can be reduced even below the average of 13½ cts.

——THE CHICAGO, MILWAUKEE & ST. PAUL CO. has just begun running two new vestibule trains between St. Paul and Chicago, heated by steam and lighted by incandescent electric lamps.

RAILWAY PROJECTS IN ECUADOR were reported on a few months ago by the U. S. consul at Guayaquil. In 1885 the Government made a contract for the construction of a line 50 miles long from Chimbo to Sibambe, being an extension of a line built by the Government about 15 years ago from Yaguache, at the head of navigation on the Yaguache river, to Chimbo. In 1888 the contractor assigned his contract to the Railway & Public Works Co., of Guaayquil, and that company began the grading. The extension will pass for the greater part of its length through a mountainous region, reaching an elevation of 7,500 ft. at Sibambe. The land is said to be fertile, but the population is scarce. There is some probability of the line being continued to Quito. In 1887 the Government granted a concession for a line from Duran, near Guayaquil, to Yaguache, 14 miles; the line runs through a grazing and agricultural country and was to be opened in December, 1888. In 1887, also, a concession was granted for a line from Bahia de Carequez, a port on the Pacific, to Quito; a little grading has been done, but as the line will pass mainly through a mountainous region, almost uninhabited, it is thought to be a difficult and costly enterprise.

CORRESPONDENCE.

Safe Loads on Piles.

CINCINNATI, O., Jan. 3, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

Your issue of Dec. 29, 1888, contains a communication from Mr. J. C. TRAUTWINE, JR., from London, asking F. P. K. if he can give extreme load upon one of his trestle piles and if not, to say how much they safely bear.

Allow me space to say that the piles driven by me have not been depressed by the passage of trains, and I am therefore unable to state the extreme load necessary for the ⅝-in.

As to vibrating load safely sustained, it is, say about 60,000 lbs. upon a bent of 4 piles, which may be the same as 15,000 lbs. (more or less) upon one pile. Assuming this quantity as correct, the margin of safety can be worked out by several formulæ; but what is the use, if a 2,000-lbs. hammer falling 14 ft. drove the pile with only one inch penetration? Mr. TRAUTWINE'S rule gives extreme load $= \frac{.023 \sqrt[3]{14} \times 2{,}000}{2}$ or 55.43 tons, while SANDERS' load as *safe* is 18¾ tons.

A safety factor of 3 for the formula $.023 \sqrt[3]{h}$ gives 18.5 tons, which is not likely to come upon any one pile in the bent, if the cap is not broken. The rule used by me in following specifications in 1872 was 2,000 lbs. fall 30 ft. with only-½ in. penetration allowed. This blow is too severe, and a fall of 10 ft. would be better if the penetration is ½-in. in practice. In the case just mentioned 10 ft. is not equivalent to one-third of 30, because experience teaches me that the penetration of piles under a 28-ft. blow is about double that from a 14-ft. blow. I do not defend or attack any pile formula in particular, as they are all unsatisfactory. Your formula is the best, according to my light, yet shown me; but the factor 2, in the numerator of equation

$$L = \frac{2\,wh}{s+1}$$

in which L = safe working load, will not work in extreme cases, while it likewise limits the conditions to 2,000 and 1,000-lb. rams with falls from 10 to 30 ft., and penetrations of 4 ins. and less.

There should be in the equation $L = \frac{wh}{s}$ a factor (practically 2) and an addition to s (practically 1), because otherwise $Ls = wh$ reduces to an "infinite absurdity" but that either the factor 2 or the addition 1 are constant, is unproven.

The idea of time in communicating the vigor of wh into s must be maintained and the form $L = \frac{V\,wh}{s+c}$ will meet the sanction of all students. As to V and c being constant for all weights of rams and penetrations, that is doubted.

Allow me to thank you for taking the matter under consideration, and giving sanction to the practical $L = \frac{2\,wh}{s+1}$ as it can be worked out by a frosty fingered inspector while the pile is being driven. F. P. K.

[Perhaps our correspondent will suggest what constants and what function of V he would introduce in his equation $L = \frac{V\,wh}{s+c}$ which will enable a closer approximation to be made than the simple form $L = \frac{2\,wh}{s+1}$, within the range of practical pile-driving, which may be said to be now, hammers 1,000 to 3,000 lbs., fall 5 to 30 ft., last penetration, ¼ to 4 ins. We know of none. That the velocity should be a factor in any exact formula is undoubted; the only question is, in what form, and is enough more precision gained to especially diminish the large margin of uncertainty? All that such a formula claims to do, or can do, is to indicate that piles are to be loaded with more than $\frac{2\,wh}{s+1}$ only with extreme caution, while it will be only under exceptional circumstances that they will not be safe for that load. ED. ENG. NEWS.]

Brick Lined Reservoirs.

FORT WORTH, Texas, Jan 12, 1889.

TO THE EDITOR OF ENGINEERING NEWS:

Will you kindly state if it is usual or feasible to revet or pave the interior slopes of earth work subsidence reservoirs with brick work laid dry, and if so what slope would you recommend for a pavement of one course of brick laid on edge, with say every 6th. or 8th. course laid as headers, and if there are any examples of such work in the country. ENGINEER.

[A slope of 2 to 1 has been commonly used to our knowledge. A number of the reservoirs of the Philadelphia Water Department are lined with brick, and it has there been the practice for years past. There are doubtless many other reservoirs in the country lined in a similar manner. ED. ENG. NEWS.]

The Weather of the United States for the Month of December, 1888.

[As respects the elements of most interest to engineers.]

According to special returns from the Chief Signal Officer of the U. S. Army.

STATIONS.	TEMPERATURE. Degrees Fah.				WIND VELOCITY. Miles per hour.			PRECIPITATION. Rain and melted snow. Inches.		
	Average	Max.	Min.	Range.	Average.	Max.	Direction at time of Max. Vel.	Total.	Heaviest in 24 hours.	No. rain days
NORTHERN CITIES.										
Northfield, Vt	25.2	52.	—7.5	59.5	10.4	48	N	2.46	1.10	15
Portland, Me	29.3	57.	2.2	54.8	8.5	34	NE	4.71	1.87	7
New York City	34.4	56.3	8.8	47.5	12.6	50	SW	4.05	2.82	8
Pittsburg, Pa	35.0	62.1	12.2	49.9	6.1	26	SE & W	1.66	0.58	14
Chicago, Ill	31.3	52.9	14.8	38.1	11.2	41	S	1.94	0.98	9
Omaha, Neb	30.4	65.8	9.6	56.2	9.0	33	NW	0.96	0.36	7
St. Paul, Minn	23.6	58.1	5.0	53.1	7.1	26	NW	0.63	0.47	4
Duluth, Minn	23.6	49.	2.	47.0	6.9	32	NW	0.25	0.09	6
Bismarck, Dak	20.9	57.2	5.	52.2	9.0	42	NW	0.24	0.18	5
Average	28.2	56.7	5.8	50.9	9.0	35.8		1.88	0.94	8.3
SOUTHERN CITIES.										
Washington City	35.2	60.6	16.2	44.4	5.5	34	NW	3.27	2.53	6
Louisville, Ky	38.5	62.	18.	44.0	7.3	33	SW	1.57	0.47	9
St. Louis, Mo	36.6	59.	20.6	38.4	9.6	50	W	2.01	0.89	7
Savannah, Ga	47.0	69.1	25.	44.1	6.2	30	W	2.87	1.23	7
Leavenworth, Kan	33.1	63.	9.6	53.4	7.2	30	S	1.57	1.20	9
Jacksonville, Fla	51.3	73.6	27.5	46.1	4.2	35	W	2.88	2.03	10
Chattanooga, Tenn	40.8	65.2	20.1	45.1	5.8	28	S	1.99	0.94	9
New Orleans, La	51.2	72.3	30.7	41.6	8.5	39	SE	3.68	1.20	11
Memphis, Tenn	42.0	66	23	43	6	34	S	3.41	1.43	11
Palestine, Tex	49.8	72.	29.3	42.7	6.3	27	W	6.58	1.40	13
Average	42.6	66.2	22.0	44.3	6.7	33.0		2.98	1.33	9.2
WESTERN CITIES.										
Helena, Mont	24.0	53	14	39	3.0	28	S	0.77	0.48	9
Port Angeles, W. T	39.0	55.2	23.9	31.3	3.3	24	NE	3.44	0.80	18
San Francisco, Cal	52.4	64.7	43.1	21.6	6.0	25	SE	5.80	1.51	17
Salt Lake City, U	34.8	57.	27.5	29.5	3.3	22	S	2.21	1.30	9
Denver, Col	33.7	67.5	7.2	60.3	6.2	30	N & NW	0.09	0.04	4
Yuma, Ariz	55.9	73.3	39.9	33.4	6.0	36	SW	0.95	0.56	4
Santa Fe, N.M	30.4	52.	15.5	36.5	5.6	34	SE	0.66	0.43	8
Average	38.6	60.7	24.4	36.2	4.8	28.4		1.99	0.73	9.6

Notes and Queries.

E. H. C., Athens, Pa. GAUTHIER-VILLARS, Paris, publish multiplication tables from 1 to 1,000. Price $4.00 plus duty. For multiplying 4 figures by 4 figures, logarithmic tables furnish the best and probably the only available method.

H. K., Kendallville, Ind. No such manual of water-works superindence as you require is yet published. The required information is in great part scattered through many books and special articles, on hydraulics generally, boiler practice, water-works construction, flow of water through pipes, etc.

Mr. F. FANNING, C. E., 328 Francis St., St. Joseph, Mo., wishes catalogue and prices of *Brass* measuring tapes mentioned in ENGINEERING NEWS of Dec. 29 and Jan. 12.

J. J. G., of East Saginaw, Mich., wishes to have from some of our readers their experience in the use of coal tar for wood pavements?

G. I., of Bay City, Mich., wishes to know more of the use of compressed wood block pavement, recommended by Mr. A. BRISBANE about 4 years ago. Can any of our readers detail experience with this pavement.

A correspondent asks if some municipal engineer who is practically qualified to do so, will report his experience with vitrified terra-cotta brick for sidewalks. Is the durability of such brick as compared with that of an ordinary well burnt brick sufficient to justify the extra cost; and generally is a sidewalk of this material satisfactory? We shall cheerfully give space to data on this subject. Boston is headquarters for brick sidewalks, but we have not known of such vitrified brick being used there.

A. R. RANKIN, Chairman of Water Board of Greenfield, Mass., wants the address of parties familiar with reservoir cleaning. The Greenfield reservoir covers 5¼ acres and has a capacity of 17,800,000 galls.

THE QUESTION OF DAMAGE BY SMOKE in great cities where bituminous coal is burned has received new light by a recent paper contributed by the Hon. F. A. R. RUSSELL, published under the auspices of the London Smoke Abatement Institution. He shows that, during the great fogs of London in 1880, fogs which were doubtless due in the main to smoke in the atmosphere, the death rate in London rose in January from the normal winter figure of 27 1-10 to 48 1-10 for the week ending Feb. 7, which was the period of densest fog. At the same time the death rate for 19 provincial towns was only 26 3-10; in other words, the cases of deaths over the average for an ordinary winter period was 2,094. He estimated that at least ten times as many persons were ill from the same cause. It thus appears that the dead and wounded in this contest with a preventable nuisance was equal to that of many famous battles. Mr RUSSELL computes that the annual loss to the population of London in the way of damage to buildings, furniture, extra washing, waste of coal, extra lighting etc., not taking into to account the enhanced death rate, amounts to about $25,000,000 a year. On this basis he makes a new appeal for an effective resistance to this great evil. Many of our American cities, particularly those of the Mississippi valley, are interested in this problem, and Mr. RUSSELL'S address might very well find republication here.

Foreign Weights, Measures and Currency.

The following equivalents are given in volumes of the U. S. consular reports, and are useful for reference:

Name.	Country.	U. S. Equivalent.
Anna	India	3 cts.
Centner	Germany	110.230 lbs.
Feddan	Egypt	1.038 acres.
Franc	France	19.3 cts.
Hectare	"	2.471 acres.
Mark	Germany	24 cts.
Maund	India	82 lbs.
Milreis	Portugal	$1.084
Ore	Sweden	100 öres = 1 crown = 26.8 cts.
Peseta	Spain	19.3 cts.
Piastre	Turkey	$0.0442
Picul	China	133.35 lbs.
Pound	Great Britain	$4.86
Pound	Egypt	$4.9641
Ruble	Russia	53.2 cts.
Rupee	India	38.2 cts.
Sol	Peru	96.50 cts.
Tael	China	$1.30
Tael (haikevan)	"	$1.20
Yen	Japan	$0.81

——HOUSTON, TEXAS, is considering the subject of street paving, drainage and sewerage. The plan of general improvement now under consideration includes the appropriation of $200,000 for streets and pavements for the first year and $200,000 as a maximum for each year in the next 10 years. For sewers, $100,000 is to be used the first year and the total expenditure in 10 years is limited to $300,000.

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Drawings for publication *should preferably be in plain black and white, considerably larger than they are expected to appear, with letters and figures in pencil only, all lines clean and bold.*

Coming Technical Meetings.

Engineers' Club of Kansas City, Mo.—Regular meeting, Jan. 21. "Electric Railways", A. M. Connett. Secy., Kenneth Allen, Y.M.C.A. Building.

Engineers' Club, Philadelphia, Pa.—Regular meeting, Feb. 2. Secy. Howard Murphy, 1122 Girard St.

Western Society of Engineers, Chicago, Ill.—Regular meeting, Feb. 6. Secy. L. E. Cooley, 171 La Salle St.

American Society of Civil Engineers, New York.—Regular meeting, Feb. 6. Secy., John Bogart, 127 E. 23d St.

Engineers' Club of St. Louis, Mo.—Regular meeting Feb 6 "Rainfall and River Discharge in the Mississippi Valley", Prof. F. E. Nipher; "Adding Machines", N. W. Perkins, Jr. Secy., Wm. H. Bryan, 709 Market St.

Civil Engineers' Club of Cleveland, O.—Regular meeting, Feb. 12. Report on Applied Science. Secy., James Ritchie, Case Library Rooms.

Engineers' Society of Western Pennsylvania, Pittsburg, Pa.—Regular meeting, Feb. 19. Secy., S. M. Wickersham, Penn Bldg.

American Institute of Mining Engineers.—The 53d meeting will be held at New York, on Feb. 19. Secy., R. W. Raymond, 13 Burling Slip, New York.

Boston Society of Civil Engineers, Boston, Mass.—Regular meeting, Feb. 20. Secy., S. E. Tinkham, City Hall.

New York Railway Club.—Next meeting Feb. 21. Rooms 113 Liberty St., New York City.

THE statement contained in a circular published last week, that in the short history of the American Society of Civil Engineers there have been five foreign born presidents will surely have struck many readers with something of surprise. When the facts are examined, it appears less surprising. There have been 18 presidents in all, of whom 13 were native-born Americans. Of the remaining 5, THOS. C. KEEFER is a Canadian, born of an American loyalist family which left this country after the Revolution with about 40,000 others, whose descendants to-day are the better part of the English speaking population of Canada; so that he is an American in all but name. JAS. B. FRANCIS is an Englishman, and either LAURIE or KIRKWOOD (we forget which) was a Scotchman, who came to this country quite young; and the only two presidents who were of foreign birth in the usual colloquial sense were ALBERT FINK and HENRY FLAD, both of whom came to this country young, and here achieved their fame in the profession that they have honored. But instead of there being ground for surprise that there have been so many foreign born presidents it is rather surprising that there have been so few, considering how large has been the crop of European engineering graduates who have had for half a century a far better field here than anywhere else in the world; and who have certainly not had their chances for the presidency injuriously diminished by the fact of foreign birth.

THE wonderful increase in the value of a square foot of real estate in our older cities, in the last decade or two, is best noted in the prevailing tendency of builders towards the so-called "sky-scraper" type of structure. As the ground costs too much to permit the erection of one ordinary, old-fashioned building upon it, they pile four and five of the structures of 20 years ago, one on top of the other The *Times* building, with its 13 stories, is the latest and by far the best example in this city of what can be done in this direction, and still preserve architectural elegance; it stands in striking contrast with some of its neighbors, which are simply brick shells to so much valuable floor space. Next to New York, Chicago perhaps has the most remarkable buildings of this type; though the charge of being rather useful than ornamental must be made against the majority of them. The Owings Building, in the latter city, on a ground area of 50 by 75 ft. runs up 140 ft. into the air to the main cornice line, and 228 ft. to the top of the corner tower; it has 14 stories and cost $300,000. The Tacoma Building, also in Chicago, occupying a space of 100 by 80 ft., stretches 165 ft. above the pavement to the cornice line. It cost about $500,000. And the new Chicago Chamber of Commerce Building, not yet finished, stands on a lot 93 by 181 ft., and will be 182 ft. high to the cornice; it is to cost $700,000. All of these buildings are theoretically fire proof; or as much so as human ingenuity and a free expenditure of money can make them.

THE three Chicago buildings mentioned show a fast increasing tendency to "go up", both in height of building and in cost, and it is a natural and interesting query to ask where this thing is going to stop, and whether in future high building there is not some danger of sacrificing safe construction to the maximum utilization of a certain limited ground area. The piling of enormous weight on a minimum foundation area and the distribution of this weight so as to best and most economically meet the purposes of erection, demands much more engineering knowledge and experience than it does mere architectural skill, as the latter accomplishment is too often interpreted. Some centuries ago, the architects were the only engineers, and they have left us many noble examples of their skill and daring and profound knowledge of the laws of construction. But in the immediate past there has been a tendency in the craft to leave constructive details of importance to the men who made a business of such work, that is to engineers, and to devote the skill and experience of the architect to the general form and decoration of the building. There are of course notable exceptions to this method of following an ancient and most honorable profession, as the late work done in the extension of the Equitable Building and the erection of the Times and other important buildings in this city prove. But exceptions only prove the rule, and the failure of the vaulted Assembly ceiling in Albany, the Memorial Hall in Philadelphia, and many other examples may be cited where the decoration was as unexceptionable as the constructive details were faulty. The time was when some training in details, some study of the works of others, good taste, and a minimum of knowledge of stresses in materials would suffice for the more or less successful erection of the great majority of buildings. But it would be a bold and reckless man who would attempt, on a similar thin capital, the design and superintendence of any one of the buildings here referred to. Yet there is the risk of such an attempt; and some corporations are quite reckless enough in the name of "economy!" to select the lowest bidder regardless of fitness or previous experience. In the interest of the occupant of the building, whether an office building or a dwelling, and in that of the public generally, there should be enacted more stringent laws than any yet existing concerning this new type of structure. The buildings have outgrown the laws, and it will require a special and intelligent effort to "catch up".

IT is not at all strange that the Congressional Committee in whose hands is placed the revision of the Interstate Commerce Law, considers that it is now obtaining more real light on the railway problem through the joint meetings of railway managers and investors than it could obtain by the most rigid cross-examination of railway men. It is indeed a strange spectacle when JAY GOULD and CHARLES FRANCIS ADAMS meet and agree to work in harmony; and when the chief representatives of the Rock Island and the Burlington systems, which less than a year ago were fighting one another in the courts,—the one alleging that the other was scheming to form a great railway trust or consolidation of competing systems throughout the West—when these companies agree to co-operate with each other and check competition both in rates and facilities, the public may well be astonished.

The meeting of the Presidents at the house of Mr. J. P. MORGAN in this city last week, at which the foundation for "The Interstate Railway Association" was laid, still continues a chief topic of interest in railway circles. But until the Chicago & Alton and the Illinois Central agree to join the Association, its success must be a matter of doubt. President CABLE of the Rock Island, indeed, refused to sign the agreement until assured that some of his chief competitors would do the same. Both President BLACKSTONE of the Chicago & Alton and General Manager JEFFERY of the Illinois Central have stated informally their approval of the objects of the Association, though if we are rightly informed, they have not signified their intention of joining it. The unfortunate position which the Chicago & Alton has taken and fought to sustain in paying ticket commissions, may tend to deter it from joining the Association, since that body has already taken strong ground against the practice.

A VERY important matter in connection with the Presidents' meeting and the present general agitation of the railway problem, is the change in public sentiment regarding the construction of parallel and competing lines. Eighteen months ago, when, as President ADAMS says, 'the great companies were possessed with a sort of mania for building extensions,' there was hardly a suggestion that the work was being overdone. Now we hear it said on all hands that the railway building of the past three years is one of the bottom causes of the present troubles. President ADAMS pointed it out in his recent address. Chairman COOLEY of the Interstate Commerce Commission says: "The proposal of a new railroad is very often a mere confidence operation. Many roads are built that instead of increasing the aggregate value of the railroad

property of the country, diminish it very largely. The millions put into them are sunk and perhaps as many millions more previously put into roads which the new road makes unprofitable."

An astonishing amount of matter has been printed of late concerning the extreme wickedness and dishonesty of railway traffic managers of every grade, from President down; most of which seems to have originated with the financiers and investors whose interests are at stake, and whose pockets suffer by reduced dividends and defaulted interest. We have already expressed our disbelief in the doctrine that railway managers are nearer total depravity than other men; but President ROBERTS of the Pennsylvania system called attention at the recent Presidents' meeting to the fact that a good portion of the blame for the present status of railway finances rests on the bankers and investors who are so profuse in their condemnation of railway managers' morals. He suggested that an association of reformed bankers might accomplish quite as much good as an association of reformed railway Presidents. When parallel lines are projected, banking houses are always ready to float bonds on commission for the projectors, without regard to the effect the new line will have on the revenue of roads already existing. Mr. MORGAN responded to this home thrust by pledging on behalf of the banking houses represented at the meeting, Drexel, Morgan & Co., Brown Bros. & Co., Kidder, Peabody & Co., and Baring Bros. & Co. and their associated firms, that when the Interstate Railway Association is established, the above houses will not float bonds for any new line not recommended by the Executive Committee of the Association; and that they will use their influence to prevent other bankers from floating bonds for such enterprises.

President HENRY B. LEDYARD, of the Michigan Central, has also expressed himself strongly in reference to the above matter, declaring that "Railroad Presidents and managers are not the autocrats they are believed to be by some people." In reference to railway construction he said:

"One of the prime causes of all this trouble may be traced directly to the policy of the banks. It is a notorious fact that any five men in this State may organize a corporation for the building of a railroad; and with no money of their own, issue bonds on the basis of $20,000 a mile, negotiate the bonds with the banks in New York on a basis of 90 per cent., which yields $18,000 a mile in cash. The road is built for $15,000 per mile, and the incorporators pocket $3,000 per mile out of the project, while the banker floats the bonds at probably not less than 95 ct and so clears a handsome profit on the deal. The interes on the bonds, $20,000 per mile, must now be paid. Th public must pay this, and if the road were simply built to blackmail an established line into buying it out of competition and was not a necessity, the whole amount invested in the venture is a loss which falls heavily on the investors.

"The banks which float the bonds and the laxity in the laws which make railroad incorporation so easy are alone responsible for the wildcat railroad building which renders existing lines unprofitable and affords a losing investment for so many unfortunates."

President LEDYARD advocates a law providing that all projected lines shall be investigated by a Government commission and their benefit to the public determined, before they are allowed to proceed.

It seems probable that the example of Maine and Massachusetts will be followed by other States, and a certificate of recommendation for any new line be required to be given by the State Railway Commission before the projectors will be allowed to build it. Should it prove so, it will be a grand reform.

IT is the tendency of public opinion to run to extremes, and it seems quite certain that the present outcry against railway extension is not quite warranted by facts, any more than was the sanguine enthusiasm which prevailed 18 months ago. A great mileage has been built in the past three years, and a considerable part of it was built to compete with existing roads. Yet there has been but very little mileage constructed of strictly parallel lines, and there are few cases where the present or prospective early growth of local traffic will not soon return a fair profit upon the actual cost of the road aside from the returns on the through shipments. Of course many extensions have been built far ahead of present requirements, and the deficit from these lines and the sharp competition by new through lines, which has had a wide effect on rates, have brought railway extension into present disrepute among both investors and railway men. While this will have some effect in checking construction, there is a very large mileage of short roads projected to develop local traffic which are entirely legitimate enterprises, and cannot justly be classed with blackmailing paralleling schemes. In the long run, the guidance of capital into these productive enterprises and the protection of investors from the seductive promises made by the projectors of the other class of extensions, will foster rather than check railway construction.

The Main Street Arch at Springfield.

Another design for the Main Street arch in Springfield, Mass., is shown in the *Republican* of that city for Jan. 8. It is submitted by Mr. E. C. DAVIS, Engineer and County Commissioner of Northampton Co., and is an endeavor, more or less successful, to retain the good and eliminate the bad features of previously submitted designs. Mr. DAVIS proposes an exceedingly heavy arch with the springing line about 7 ft. above the level of the footways. And as the 14 ft. center clearance required by the location would give a very flat arch in this span of 67 ft., he recommends giving to his arch a greater apparent center height by chamfering off the lower corner of the arch-face in a regular curve disappearing at the spring. The false arch would be emphasized by a broad draft line at its bottom, and rock-face voussoirs, and the chamfer would be made to conform in appearance as much as possible with the intrados of the arch proper. He also suggests a massive center tablet, and two center lamps above the ends of this tablet supported on stone posts or rather towers.

From an architectural standpoint, and from that of purpose as well, this plan is open to serious criticism, as illustrated in the *Republican*. In the first place the arch is crushingly heavy in appearance, notwithstanding the chamfer, which latter is much more effective in the illustration in disguising the real rise of the arch that the finished structure would be, especially when viewed from any distance. The chamfer cannot be run in very far from the face without interfering with the gradient of the railroad tracks; if it could be run in sufficiently far to be of any use in deceiving the eye, it is altogether unnecessary, as the whole arch could be given the increased rise. The width of the voussoirs, 25 in a span of 67 ft., also adds materially to the heaviness of the arch; and an ornamental haunch panel, with its lower border flush with the face of the ring stones and with joints conforming to those of the latter, has the effect of making the arch appear to be about 10 or 12 ft. deep. Even with the difference in material between the two members proposed, the eye will inevitably connect them with the unpleasant impression referred to. The panel treatment and the lamp towers are also unworthy of the site and importance of the structure.

The dimensions fixed by the Commissioners to start with, make any arch design a difficult problem at this point. So far Mr. GARDNER has submitted the best plan conforming to the required conditions. But we think, with Mr HERSCHEL, that the stone screen demanded for each side of the railroad is an unnecessary feature and the real stumbling block in the way of any effective arch design. This screen in stone is a stone lie; for its effect is to deceive the observer into believing that the mass above the key is solid masonry and that there is some necessity for this massive construction. To add further deceit by using a false arch-face is only to further violate the canons of good taste and true architecture.

Thousands of horses daily pass beneath the elevated railroads of this city, in full view of swiftly moving trains, and under a clatter that is immeasurably greater than anything that could be expected in the case of a heavy stone arch, and accidents are so rare that we cannot recall a single serious casualty. It is what the horse hears rather than what he sees that causes fright: and consequently if they do travel without trouble under a noisy metallic roadway, they surely should be less troubled under an arch.

But if Massachusetts horses are more timid than those of New York, and they must be prevented from seeing passing trains, a sheet of tin would answer every useful purpose. The real conditions are—a stone arch carrying a railroad, and a screen to prevent horses from seeing and being frightened by passing trains. But it is not at all necessary that we should unite these two features of entirely different purpose in one structure. When we require an arch we build an arch: and so when a screen is wanted why not build one, instead of lying about it? The arch demands stone as a material of construction; but the shield could much more appropriately be built of some other material; wrought-iron, cast-iron or copper, in the hands of a true architect, should be made to yield very artistic results.

In the design of Mr. GARDNER, the arch is surmounted by a broad, ornamental belt which implies a screen or parapet wall, and for this reason is the most pleasing to the eye of any submitted, for it leaves the arch to be treated as a separate member. The fact that this screen is stone and hence might be mistaken for an integral part of the arch is the only valid objection to this plan. We would like to see the same gentleman handle the metallic screen. There would be no objection to surmounting an arch by an artistic wrought-iron railing and the screen required is little more, save that the members should be close together or even backed by solid iron or copper. It is the utterly different materials, requiring different treatment, that would tell the tale and tell the truth. So let some of the Springfield architects try again on this interesting problem.

Fire Losses and Timber Supply.

A movement for the compulsory investigation of fires, by Fire Marshals or other like officers in cities, and by coroners in small towns and villages has been started in this and several other States. In defense of it it is stated that the average reported fire loss in the United States for the past 5 years has been almost exactly $100,000,000 per year, and in New York State alone it amounts to over $15,000,000, or $6,000,000 more than the average levy for tax purposes. The annual yearly increase of taxable property in New York is stated at about $100,000,000, so that over one-seventh of this sum is destroyed annually by

fire. It is claimed, and probably with truth, that half of this yearly loss may easily be saved by a sufficiently rigid system of inspection and investigation alone, without any difference in construction.

These figures, however, tell but about half the truth. Mr. EDWARD ATKINSON, whose labors as President of the Boston Manufacturers' Mutual Fire Insurance Co., and in the general field of economic statistics, have given to his words a just authority, states in a report dated Feb. 28, 1887, that the annual United States fire loss may be stated at $100,000,000 to $115,000,000; the cost of maintaining the insurance companies, $35,000,000 to $40,000,000; the cost of sustaining fire departments, at least $25,000,000 (which seems to us a very low estimate if public and private watchmen are likewise included) and the net aggregate of the entire fire tax, $160,000,000 to $180,000,000 per year. This, be it noted, is entirely apart from the loss of life and limb and the indirect losses of fire, by interruption of business and loss of books and papers, and of valued and valuable property on which it is difficult to place a money value.

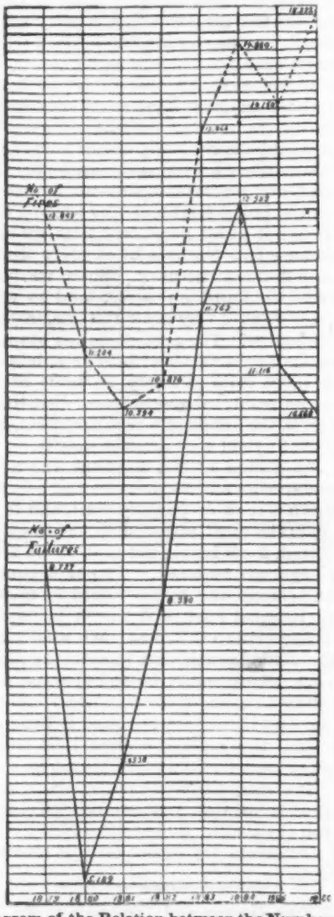

Diagram of the Relation between the Number of Fires and the Number of Business Failures During Eight Years.

The "Chronicle Fire Tables" for 1887 show that in 1886 there were 15,222 noteworthy fires (as distinguished from incipient ignitions) in the United States, against 14,114 in 1885, the value burned being $104,924,750 (largest single loss, 1¼ millions) against $102,818,796 in 1885. These reports are based on insurance adjusters' estimates for the most part, which are well known to run under the real loss to individuals. In 1886 only 26 per cent. of the United States aggregate was of incendiary origin, which was far below the average; but that there are in every year many more incendiary fires than any reported statistics show, is indicated in a striking manner by the accompanying diagram, showing the synchronism of more or less business failures and more or less fires, as also by another fact to be noted.

The "Chronicle" gives a table of the percentage of incendiary fires by States for 4 years, 1883-6 inclusive, from the average for which period we rearrange the following table, so as to give the comparative status of groups of States:

Percentage of Incendiary Fires by States and Sections, 1883-4-5-6.

Me.	27		Ohio	37	
N. H.	18		Ind.	46	
Vt.	26	Av. New Eng.	Ill.	18	Av. No. Central
Mass.	22	27.0	Mich.	27	31.8
R. I.	25		Wis.	31	
Conn.	44				
			Ia.	38	
N. Y.	23		Minn.	30	Av. N. W.
N. J.	23		Kan.	29	34.5
Pa.	22	Av. Middle	Neb.	41	
Del.	36	24.6			
Md.	19		Mo.	47	
			Ark.	52	Av. S. W.
Va.	40		Tex.	47	46.75
W. Va.	51		Col.	41	
No. Ca.	51	Av. So. Atlan-			
So. Ca.	51	tic, 47.3	Cal.	15	
Ga.	48		Or.	23	Av. Pacific
Fla.	43		Nev.	43	27.0
			Average of U. S. for same 4 years, 30.4.		
Ala.	49				
Miss.	54	Av. So. Central			
La.	34	48.6			
Tenn.	52				
Ky.	52				

It would be idle to deny that our Southern fellow-citizens do not show up very well on the face of this table, and they pay for it in higher insurance rates; but before unfair deductions are drawn from this fact, we hasten to point out that the percentage may become large either from many incendiary fires or few other fires; and that in the South the proportion of dwellings and other isolated buildings is much larger than in more thickly settled regions, and that such buildings are much less liable than others to honest causes of fire. This will by no means explain the whole difference, but it explains a considerable part of it.

The "Chronicle" tables likewise show that in the same 4 years there was lost from fire in the entire United States:

Human lives	1,666
Horses	8,499
Cattle	5,855
Other animals	22,126

The leading causes of fire in 1886, in order of numbers, to which we add the percentage of each, were:

	No.	Per cent	
Incendiary	1,954	25.4	
Defective flues	1,004	13.1	
Sparks (119 loco.)	647	8.4	
Stoves and heaters	561	7.3	
Explosions (lamps, gas, etc.)	534	6.9	
Matches	498	6.5	
Lightning	356	4.6	
Spontaneous combustion	249	3.2	
Gas and chemicals	236	3.1	
Fireworks and crackers	160	2.1	
Lamps and lanterns	155	2.0	
Forest fires	148	1.9	
Cigars and tobacco	137	1.8	
Accidents	115	1.5	
Friction	114	1.5	
Open fire-places and ovens	104	1.4	
Engines and boilers	102	1.3	
Ashes and hot coals	89	1.2	
Carelessness	83	1.1	
Stove pipes	79	1.0	
Tramps	41	0.5	
Minor known causes	327	4.2	
Total known causes	7,668	100.0	50.6
Unknown or unreported	7,524		49.4
Total fires in U. S	15,222		100.0

It will be seen that nearly half of the fires are of unknown or unreported origin, and there is, of course, a strong probability that a much larger proportion of incendiary fires exists among those for which there was no known cause, than among those for which a cause is reported, so that considerably over one-half of all fires are probably of incendiary origin.

But while there will be seen to be considerable diversity in the primary causes, it may be said of nearly all of them, and still more of the fires of incendiary origin, that a secondary cause is still more important, the ease with which American buildings are set on fire; the extent to which soft pine and other easily ignited woods are used, in preference to other styles of construction, because of the cheapness of wood in this country. It is not as generally appreciated among Americans as it should be, that we are peculiar in this respect among all civilized nations; that there is no other civilized nation on earth which suffers half as much from fire as we do, or exposes itself to such risks. That it is entirely uneconomical to run such risks we believe, and shall attempt in part to show.

According to the estimate of the total wealth of the United States in the census of 1880, the total of property exposed to destruction by fire was:

Residence and business real estate, including water power and value of land	$9,881,000,000
Household furniture and clothing	5,000,000,000
Churches, schools and public buildings not taxed	2,000,000,000
Agricultural, mfg. and other products on hand	6,160,000,000
Total	$23,041,000,000
In a grand total of	43,642,000,000

Some items not included above, like specie, mechanics' tools and railway rolling-stock, are exposed to destruction by fire, but on the other hand a full half of the great first item is for land not open to destruction by fire. The aggregate of insurance affords better evidence, since nearly all property exposed to fire is insured. It is estimated by Mr. ATKINSON in the publication before referred to that the aggregate of insurance against loss by fire was in 1886 about $12,000,000,000. Estimating that excess of valuation over insurance and uninsured property will amount to 67 per cent. more, and we have a total of property exposed to combustion of $20,000,000,000, of which over $100,000,000 is destroyed by fire annually, or ½ of 1 per cent.

This may sound at first like a very small loss, not warranting a different style of construction, but it is not so. In the first place there is to be added a nearly equal sum for cost of insurance (which is loaded nearly 100 per cent. to cover expenses and profits), fire departments, watchmen and other precautionary measures, making a total loss by fire and danger thereof of nearly 1 per cent. Now the total productive or renting value of all the buildings of the United States, in excess of taxes, repairs and deterioration, cannot be rated at more than 5 per cent., if indeed it should be rated as high, whence it appears that *one-fifth* of the productive value of the average building is sacrificed by its inflammability. But if one-fifth of the annual income be thus sacrificed, it follows that the first cost of the original building, taking the average of the whole United States, might be increased *one-fourth* without loss, if the risk of fire can thereby be eliminated, or even reduced to very small proportions, since we may surely place some money value on the danger to life and limb and the miscellaneous losses from fire not directly measurable in money. Mr. ATKINSON, by an entirely different path, reaches a still larger estimate than ours, in the following words:

"The aggregate of the fire tax is $160,000,000 to $180,000,000 per year. If the people of this country average $200 worth of products per person, or $600 to each group of three, of whom one supports the two others, our annual product is now $12,000,000 upon which the fire tax is 1⅓ to 1½ per cent., or, assuming that we can save 10 per cent. out of the product as net income, or $1,200,000,000, *the loss by fire only*, aside from the cost of insurance and fire departments, is equal to $8 to $10 on each $100 now added to our capital. But we call ourselves an intelligent people!"

This shows a direct destruction by fire of nearly 1 per cent. of the entire productive capacity of all property and labor within the country, instead of a loss of 0.5 per cent. of the renting value of buildings only, or at least five times as much as we have estimated. If Mr.

ATKINSON's estimate be right we could afford to nearly double the cost of buildings to make them fire-proof. But whether the *average* yearly loss by fire on all buildings be 1 per cent. or 5 per cent. of their original cost does not greatly affect the conclusion as regards about half the buildings in the United States. Let us call it only 1 per cent. In a rough way half the total value of buildings may be said to be in dwellings and half in business property, churches, schools, etc., but the percentage of loss on dwellings is very small. In 1886 the total loss on dwellings was only $10,817,063, or 10.3 per cent., leaving $94,107,687 as the loss on the other kinds of buildings. It may be said with substantial truth that the total loss per cent. by fires including cost of protection against fires (only important in towns where buildings are crowded together), is not very far from ten times as much as the cost of insuring dwellings; but calling it only five times as much, and using only our own smaller figures for the ratio of fire loss to annual productiveness of real estate, it follows that if the average justifiable increase of cost on all buildings to make them fire-proof be 25 per cent. as estimated, the justifiable increase to fire-proof dwellings will be only 8⅓ per cent., while the justifiable increase of cost to make buildings other than dwellings fire-proof will be 41⅔ per cent. *as an average of the whole United States*, which percentage will be greatly increased in certain specially dangerous districts, like the business centers of our large cities.

The data cannot be obtained without a large amount of investigation for a more precise estimate, but as exaggeration has been carefully avoided in every detail, the real percentage by which we could afford to increase cost of construction in our cities in order to minimize danger of fire is probably nearer to 80 per cent. than 40 per cent., regarding it merely as a pecuniary question and placing no value on the danger to and loss of life. But, while expenditure would probably enable us to eliminate completely all danger of fire, a very moderate additional cost, say 25 per cent., is sufficient to save much more than half the risk of fire; to make incendiary fires difficult and slow to start; to make communicated fires, and fires from bad flues, stove pipes, engines, ashes and what not, all but impossible, and the extension of those arising from other causes so slow as to do little damage. Not one in ten of the terrific fires which threaten whole cities or districts, and occur almost yearly in all our large cities, would be likely to occur if even a third more money were spent for more nearly fire-proof construction.

The force of this argument is somewhat weakened by the fact, pointed out by Mr. ATKINSON in the paper referred to, that from ⅓ to ½ of the annual loss by fire can be saved and (in the Mutual Factory insurance) has been saved simply by a rigid system of inspection, and the enforcement of ordinary care and caution in precautions against fire not extending to the length of a different system of construction. No doubt this is true, but still it is to be remembered that in foreign countries no such careful systems of inspection exist, and certainly no system of fire departments at all comparable to ours; foreign fire departments being a standing joke among Americans, although whether the laugh is really on our side, is more than questionable. Nevertheless, foreign nations of all grades of civilization succeed in keeping their per cent. of fire losses far below ours, even with all our precautions; so that the fundamental cause of our excessive fire losses seems to come back after all, not to negligence pure and simple (which can never be wholly eliminated on a large scale) but *to the excessive use of wood in construction*, in which we outstrip all foreign nations. For example, throughout Mexico and Central and South America there are rarely, if ever, any fires of moment. There are a great many large and populous cities, with no fire department worth mention in them, and with many large warehouses stored with goods; yet there are rarely any fires of any kind and those that occur are confined to one building for the most part, and often to one floor. The same is true in substance of England and Europe. There are occasional great fires, but the aggregate is trifling compared with our own. Great Britain loses about $46,000,000 by fire only; Germany, about $31,000,000 only; France, about $15,500,000 only. Russia, which has much of the same bad style of building that we have, loses $70,000,000 annually; we cap the climax with $100,000,000. Had we no better protection against fire than European nations have, we should probably burn up three or four times this amount; had they as good protection as we, they would doubtless save at least half of their loss.

Our householders being fully as intelligent, and presumably as care-taking; and the use of flimsy wooden construction, soft wood instead of hard, thin flues and party-walls, timber roofs and cornices, light floors and "stud" partition walls, being far more common in this country, the true cause of our excessive fire loss seems to be clearly the excessive use of wood; and in view of this fact can the great cheapness of wood in this country be regarded as an unmixed blessing, or its probable increase from exhaustion of supply an unmixed evil? If wood could be properly used, its cheapness would be an unmixed blessing, just as, if whiskey could be properly used, its cheapness would be an unmixed blessing. If it were sold at cost, *and no more were used*, the burden on the poor of the liquor traffic would be reduced nearly four-fifths; but the trouble is, more is used; and since experience has shown that, so long as wood is very cheap, people will use it to an improper extent in place of better but somewhat more costly construction, we are unable to feel any sympathy with the tears shed over the possible exhaustion of our "timber supply" which means, usually, our soft pine supply, the cheapest and "handiest", but the most dangerous of all timbers. If there were any possible danger of a scarcity of timber it would be another matter, but there is no such danger. According to the census of 1880 some leading sources of timber supply stood thus, in *millions* of ft. B. M.

	Amt. Standing.	Cut in 1880.	Years' supply.
White pine	87,435	7,751	11
(do Canada	(40,000)	(2,000)	(20)
Yellow pine	127,119	1,195	150
Spruce "	101,615	335	
Loblolly "	21,000	62	340
Spruce	7,265	554	13
Cal. red wood	25,825	187	140
Hard wood (Mich., Minn. and Wis. only)	200,000	718	279

The total cut of timber was 18,991 million ft. B. M. The terrible consumption of timber for ties was estimated to require 26,500 sq. miles only to maintain perpetual supply, or about the area of West Virginia, which is probably an over-estimate.

It is difficult to see the slightest ground for alarm in any of these figures—besides the grave doubts of their correctness. They almost certainly err by omission. Thus, the annual cut of white pine has increased greatly since 1880 (we have not the exact figures at hand) and as there was only 11 year's supply 8½ years ago, we ought to be now within a few months of its total exhaustion. We have not observed any evidence of this fact in the market prices, nor in the state of the saw-mill industry; but if it should lead to the general use of hard woods for domestic building and to the absolute prohibition of any but the so-called "fire-proof" construction in the heart of our great cities, all we can say is—we hope that dreaded day is in fact but a few months off. No building by itself is fire-proof in the midst of a general conflagration, but if all buildings were of fire-proof construction, general conflagrations would not be possible. All our large cities have now certain "fire-limits", within which no wooden buildings are allowed. By establishing a new kind of "fire limit" in our great cities within which no wooden floors stairways, "studdings" and lath were allowed, within 10 years most of the very inflammable buildings would be isolated, and within 20 years few of them would be left, with great resulting gain to all concerned.

PUBLICATIONS RECEIVED.

Annual Report on Improvement of the Harbors on Lake Superior and Michigan, in charge of Maj. CHAS. E. L. B. DAVIS, U. S. Engrs. Pub. Doc.

The improvements in this district chiefly consist of two parallel pile and crib piers carried out from the mouths of rivers to sufficiently deep water, generally about 50 per cent. deeper than the desired minimum depth.

Second Report of the Board of Electrical Control for the City of New York. Dec. 21, 1888.

The work of the Board as reported here has already been given in substance in our news columns. A considerable part of this document is devoted to the late Mayor of New York, and his alleged refusal to assist the Board by an exercise of power. The charge that he has not sanctioned the present subways by a single vote in favor of their construction is rather to the credit of the Mayor than otherwise. In connection with the charge that escaping steam from the pipes of the Steam Heating Co. seriously interferes with the efficiency of the wires, the report states that over $250,000 has been already expended by the Steam Heating Co. in repairing defective construction; an item not particularly encouraging to stockholders in this company. The Board of Electrical Control thinks that the steam heating plant must either be rebuilt or its use abandoned in the sections where it now gives trouble. The report of the electrical expert shows about 1,436 lines of useless wires and 955 dead or useless telegraph poles in existence on Dec. 15, 1888.

The electrical companies and the Department of Public Works have removed 776 poles and 946 miles of wire from the streets since the Board was organized; sums which represent about the total of the good accomplished by this body. The report does not even estimate the total of poles and miles of wire in the streets of New York; but it gives 4,535.2 miles as the total length of electrical conductors now in the subways. Of this total, 4,062.32 miles belong to one company, the Metropolitan Telephone & Telegraph Co.; while the Western Union Co. has buried only 89.08 miles; a striking difference in utilization of subways that calls for an explanation, when we consider the total reported subway capacity, as built, is 34,665 miles. The single duct conduits built for electric light and power amount to 600 miles; but of this amount the Brush Electric Light Co. utilizes 8.87 miles; the Edison Co., 192.23 miles, a total of 201.10 miles. The latter half of the report is devoted to affidavits from electrical experts in New York and Chicago certifying to the feasibility of underground wires.

Second Annual Report of the Interstate Commerce Commission. 9 x 6 ins. 354 pp. Washington Government Printing Office, 1888.

The advance sheets of this report were abstracted and reviewed in ENGINEERING NEWS of Dec. 8, 1888. The complete report contains besides the matter already made public, appendices giving a statement of existing railway legislation in Canada and in England, showing in detail the work accomplished by the Commission, forms and instructions for making annual reports, and the report of Prof. HENRY C. ADAMS, Statistician to the Commission. The latter contains a most commendable statement of the value of and necessity for accurate statistics concerning all departments of railway work. The statistical portion, owing to the extremely short time allotted for its preparation, is only a preliminary statement and necessarily incomplete. In preparing Table 1, a classification of existing railways and mileage for the year ending June 30, 1888, the reports received from the companies have been supplemented by the use of *Poor's Manual* and *Engineering News Atlas of Railway Construction*, and the list seems to be very complete and carefully made. The figures for new construction are also credited to the latter authority. Only the summaries of the other tables are given, but they promise to give when completed matter of great interest and importance.

PERSONAL.

Mr. GEORGE HATHORNE, architect, of New York, died on Jan. 13.

Mr. C. C. WENTWORTH, Principal Assistant Chief Engineer of the Norfolk & Western, has resigned.

Mr. L. B. PAXSON has been appointed Superintendent of Motive Power of the Philadelphia & Reading.

Capt. W. W. RICH, Chief Engineer of the "Soo" road, has been appointed Assistant General Manager.

Mr. D. B. ROBINSON has been appointed Assistant General Manager of the Atlantic & Pacific, with headquarters at Boston.

Mr. BENNETT H. YOUNG, President of the Louisville Southern has resigned, and Mr. THEODORE HARRIS has been elected in his place.

Mr. J. M. BUCKLEY, Assistant General Manager of the Western division of the Northern Pacific, has resigned.

Mr. JOHN BUCKLEY, contractor, of West Philadelphia, was killed recently by a fall of earth in a deep trench for a culvert at the Belmont Driving Park.

Mr. GEORGE B. SWIFT, Commissioner of Public Works, of Chicago, has resigned his position, which he has held since April, 1887.

Mr. M. R. MORAN, General Manager of the Jacksonville, Tampa & Key West has resigned.

Mr. H. L. HIGDON, Chief Engineer of the Austin & Northwestern, with headquarters at Burnet, Tex., has resigned to accept a position on the Victoria branch of the Southern Pacific. Mr. W. J. CLAYBORNE, of Chicago, succeeds him.

Mr. HOWARD D. MCLEOD, Superintendent of the Southern division of the New Brunswick Railway, has resigned. The office will be abolished and its duties will devolve upon General Manager CRAM.

Mr. JOHN BLACK, of Lima, O., formerly Master Mechanic of the Cincinnati, Hamilton & Dayton, has been appointed General Master Mechanic of the Chicago & Atlantic, with headquarters at Huntington, Ind.

Mr. ROBERT LAW, formerly Assistant General Manager of the Middle division of the Northern Pacific, has been appointed Superintendent of the Montana Union Railway, which is operated jointly by the Northern and Union Pacific.

Mr. LOUIS LESAGE, late Superintendent of the Montreal water-works, died in his 62nd year at Verdun on Jan. 9, of paralysis. Mr. LESAGE has been at the head of the water department of Montreal for the past 33 years, and the many excellent features of these works are due to his engineering skill. He was elected a Member of the Am. Soc. C. E. on Sept. 7, 1881.

Messrs. J. J. R. CROES, J. P. DAVIS and W. F. SHUNK, who as a board of experts lately examined and reported upon the proposed Quaker Bridge Dam, have been paid the sum of $4,000 each by the Aqueduct Commission, in full for professional services and expenses connected with their labors, as per bill rendered and approved by the Committee of Finance and Audit.

Mr. W. HILDENBRAND, Consulting Engineer for the Roebling works, and long connected with the East River bridge, has opened an office at No. 1 Broadway, N. Y., for general engineering work in connection with suspension bridges. He is also the American representative of HERR ROMAN ABT for the introduction of the rack-rail system for railways of steep gradient.

Mr. STACEY B. OPDYCKE, Jr., has been appointed General Superintendent of the Hartford & Connecticut Western and Mr. R. P. MARTIN, has been appointed Division Superintendent. Mr. OPDYCKE was formerly Superintendent of the New Haven & Northamton, but since 1887 has been attached to the engineers' department of the New York, New Haven & Hartford.

Mr. ARTHUR F. GRAY and Mr. J. H. FITCH, formerly with the Arlington Mills, have formed a co-partnership under the firm name of Gray & Fitch for the transaction of a general engineering business, with headquarters at No. 246 Essex St., Lawrence, Mass., where they will be pleased to meet their friends. They will make a specialty of mill construction.

Mr. A. W. JOHNSON has been appointed Superintendent of the Eastern division of the New York, Chicago & St. Louis, vice Mr. GEO. H. KIMBALL, resigned. Mr. JOHNSON has been since, April, 1884, Division Engineer of this division, with headquarters at Cleveland. He entered railway service in 1875, as a draughtsman in the office of the General Superintendent of the Pan Handle road. Three years later he was appointed Assistant Engineer of the same road. He was later connected with several Western roads, coming to Cleveland in 1884 from the Superintendency of the Leavenworth, Topeka & Southwestern road.

Mr. SAMUEL SPENCER, Ex-President of the Baltimore & Ohio system is according to reports in the daily press, to become Vice-President & General Manager of the East Tennessee, Virginia & Georgia, President of the West Virginia Central & Pittsburg, and President of the New York Central & Hudson River system to succeed Mr. CHAUNCEY M. DEPEW, when that gentleman takes a portfolio in President HARRISON'S cabinet. Weaving stories concerning Mr. SPENCER'S future sphere of activity seems to be a favorite occupation just now for imaginative newspaper reporters.

Mr. T. H. SHAUGHNESSY, Assistant General Manager of the Canadian Pacific, has been appointed Manager of the lines south of the main line, and Mr. J. M EGAN, formerly of the Chicago, St. Paul & Kansas City, has been appointed Manager of the main line across the continent. Mr. VAN HORNE retains the position of President and General Manager. It has been decided to divide the Canadian Pacific system into two main divisions, one stretching from Quebec to Vancouver, and the other to be composed of the acquired or leased lines south of the trunk lines. These are the Ontario & Quebec, the Credit Valley, the Southeastern, the International, the line through Maine, and the line under construction, having for its objective point the Wabash system at Detroit, and ultimately Chicago.

SOCIETY PROCEEDINGS.

Engineers' Club of New York City—The first annual meeting of this organization was held at Victoria Hotel, New York, Jan. 15. The membership is now about 200, and it has been determined to secure a building. The prospects are that the Club will become a successful institution.

American Society of Civil Engineers.—Annual Meeting. The sessions began at 10 A. M. Jan. 16. There was a large attendance, as given below. The report of the Board of Direction was as follows:

REPORT OF THE BOARD OF DIRECTION.

[We abbreviate considerably the merely formal parts. ED.]

Membership.—As shown by the tabular statement, hereinafter given, there has been during the year an addition of 176 to the various grades of Society membership. In this nominal addition of 176, there are included 3 Members transferred to Honorary membership and 17 Juniors transferred to membership, therefore, the actual new additions to the Society membership during the year number 156. The actual additions to the Society membership during the previous year, 1887, amounted to 91.

The losses from the Society membership have been 24, being 15 by death and 8 by resignation. The number of persons now connected with the Society is 1,243, being greater by 133 than at the end of the previous year.

The actual net increase during the year and the present total in each class of membership, are:

Honorary Members, decreased during year	2	total	166
Corresponding Members			35
Members, increased during year	106	"	944
Associates, increased during year	3	"	48
Juniors, increased during year	24	"	144
			1,149
Fellows, not included above, decreased	2	total	54
Subscribers to the Building Fund, not included above		"	40
Increase during year	133	total	1,243

Annual Convention.—The Annual Convention was held at Milwaukee, Wis., June 28 to July 4, 1888. There were 133 Members in attendance, with many members of their families. Excursions were made to points of interest in Milwaukee and vicinity and also to Appleton, Kaukana, Oconomowac and Waukesha, and after the close of the Convention, a number of Members visited the mining regions of Wisconsin and Michigan, and the Sault Ste. Marie.

Meetings of the Society.—Twenty-two meetings of the Society were held during the year, one of which was the Annual meeting, held in New York Jan. 18, 19, and another the Annual Convention, held at Milwaukee, Wis., June 28, July 4, all the sessions of the Convention, including the business meeting, being counted as one meeting of the Society. Nineteen meetings of the Board of Direction have been held during the year. Collations, provided entirely by subscriptions of the Resident Members, have followed all the regular meetings of the Society at New York.

Society House and Building Fund.—A special committee of Members of the Society has in charge the ascertaining whether an amount can be obtained from among persons connected with engineering interests for the purpose of the erection of a large and suitable edifice for the future occupancy of the Society. In the meanwhile, as it is probable that some time will elapse before such a building can be erected, the Board of Direction has, under the authority specially given it, determined to erect an extension of the present house which will accommodate the meetings of the Society and the library temporarily.

The Norman Medal; for 1887 was awarded to Paper No. 340, "Evaporation", by DESMOND FITZGERALD, M. Am. Soc. C. E. The Board of Censors to award this medal for the past year will report at the present meeting.

The Rowland Prize; for the year 1887 was awarded to Paper No. 361, "Steel; its Properties, its Use in Structures and in Heavy Guns", by WM. METCALF, M. Am. Soc. C. E. The Committee to award this prize for the past year will report at the present meeting.

Amendments to the Constitution.—A number of amendments to the Constitution were submitted in due form, considered at the last annual meeting, and voted upon, the vote being canvassed at the meeting of March 7, 1888.

Of these an amendment to Article XVIII. was adopted, as follows: "Proposals for admission to the Society of Engineers not resident in North America, and who may be so situated as not to be personally known to five members of the Society, may be endorsed for ballot by five members of the Board of Direction, who shall, for such purpose, secure evidence sufficient, in their opinion, to show that the candidate is worthy of acceptance."

Under this provision of the Constitution, members of the Board of Direction have in a number of cases, endorsed for ballot certain Engineers who were not personally known to a sufficient number of members of the Society, and in regard to whom evidence was given that they were worthy of membership.

The following amendment to Article XIX of the Constitution was also adopted: (one providing for an open ballot if demanded by 8 members on behalf of a defeated candidate for admission). But one case has been presented to the Board under this provision of the Constitution, the open ballot upon which has been recently issued, to be canvassed at the next meeting of the Society. The other proposed amendments to the Constitution are given in the Proceedings for January, 1888, and were not adopted.

Report of the Committee as to Grades and Titles of Engineers on Public Works.—This report was printed in the September Proceedings.

Report of the Committee to Consider the Proper Relation to each other of the Sections of Railway Wheels and Rails.—This committee presented a report of progress at the Annual Meeting. Its preliminary report has since been submitted to the Society in the Transactions for July. The committee will be called upon at this meeting for any further report they desire to make, and the subject will be one open for discussion.

Report of the Special Committee on Uniform Standard Time.—This committee made reports at the Annual Meeting and also at the Convention. An additional report will be expected at the present meeting.

The Committee on the compressive strength of cement and the compression of mortars and settlement of masonry made reports at the Annual Meeting and also at the Convention; the latter report having been published in the Transactions for June of the past year.

Transactions of the Society.—The publication of the Transactions has been continued regularly during the year. Communications addressed to the Board in reference to matters connected with the Transactions have been carefully considered and the Board, in order that full information as to its previous action upon this subject might be given to all interested, issued the following circular:

"The Board of Direction of the American Society of Civil Engineers invites professional papers and communications on subjects of engineering interest from all persons, whether Members of this Society or not. These papers and communications will be accepted for publication in the Transactions of the Society, subject to the regular rules prescribed by the Society laws in regard to its publication. These rules provide for a proper editorial supervision, and for the exclusion of old matter readily found elsewhere, of matter specially intended to advocate personal interests, of matter carelessly prepared or controverting established facts, and of matter purely speculative or foreign to the purposes of the Society.

"Discussion is also invited from all persons interested in the papers presented to the Society, such discussion to be, of course, subject to the same editorial rules.

"The Transactions of the Society will be sent to any subscriber at the rate of $10 per year; and to clubs of 10 or more, when ordered through the Secretary of an Engineering or Technical Society or Club, who will be responsible for the payment, at 25 per cent. discount."

In reference to the copyright upon Transactions, the Board has declined to make any modification of the past system. At present, anybody is permitted to make any proper use of the publications, and there has been no interference with, or objection to the reproduction of matter from the Transactions, provided it be in proper publications and that due credit be given to the author and to the Transactions. The Board considers that it would be undesirable to eliminate the only means of correcting a misuse, if such should occur.

Suggested Visit of Members of the Society to Europe.—A communication from the Institution of Civil Engineers, was received in December last, in reference to a probable visit to Europe of Members of the Society during the International Exhibition to be held in Paris in 1889. This letter has been transmitted by circular to all the Society membership, together with some information as to arrangements that may be made if a suitable number of members desired to make such visit. Other engineering organizations are considering such similar arrangements. Replies have been received from a large number of members of this Society and over 100 have signified their expectation of making such a trip, if arrangements be perfected for that purpose.

The changes have been,

	Additions.	Losses by death.	resignation.	transfer.	Net increase
Honorary members	3	1	—	—	2
Members	124	9	6	3	106
Associates	5	—	2	—	3
Juniors	43	1	1	17	24
Fellows	1	4	—	*	−2
Total	176	15	9	20	133

*1 Member resigned but continues a Fellow.

On Jan. 1, 1888, there was as stated in the last annual Report, 56 proposals pending; 215 proposals have been received during the year. There are 36 proposals now pending.

The Library has been increased during the year by the following additions;

Books and Pamphlets	669
Maps, Plans, Drawings, Charts, Photographs and Engravings	375

The Society has lost, by death, during the term covered by this report, one Honorary Member: SQUIRE WHIPPLE; nine Members: WILLIAM L. BAKER, SAMUEL B. CUSHING, CHARLES H. FISHER, QUINCY A. GILLMORE, CHARLES LATIMER, FREDERICK MERCUR, HENRY W. B. PHINNEY, JAMES L. RANDOLPH and HENRY F. WALLING; one Junior WILLIAM A. G. EMONTS and four Fellows: GEORGE AINSLIE, GEORGE W. CASS, SPRINGER HARBAUGH and DAVID A. STEWART. Messrs AINSLIE and HARBAUGH died previous to this term; these deaths however were not announced until the present year.

Respectfully submitted,
JOHN BOGART, *Secretary.*

[The following statistical matter accompanies the report.]

On Jan. 1, 1888, the date of the last report, the Membership in the Society was:

Honorary Members resident	3	Non-res't	5	Total	8
Corresponding Members	—	"	3	"	3
Members, resident	168	"	670	"	838
Associates "	11	"	34	"	45
Juniors "	29	"	91	"	120
Making, resident	211	Non-res't	803		1,003
Total					1,014
Fellows 62, of whom 6 Members are included above, leaving					36
Subscribers to the Building Fund; 140, of whom 89 are entered in one or other of the above classes, and 11 deceased, leaving					40
Total connected with the Society, Jan 1, 1888					1,110

At the present date, Jan. 1, 1889, the membership is:

Honorary Members resident	7	Non-res't	3	Total	10
Corresponding "		"	3	"	3
Members, resident	193	"	751	"	944
Associates "	12	"	39	"	48
Juniors "	40	"	104	"	144
Making resident	252	"	897		1,136
Total					1,149
Fellows 59, of whom 5 Members are about leaving					54
Subscribers to the Building Fund 140, of whom 87 are entered in one or other of above classes.					

TREASURER'S REPORT.

On hand Dec. 31, 1887		$6,505.52
Current dues from 944 persons	14,452.00	
Past dues from 96 "	2,170.27	
Advance dues (1889) 183 "	2,955.19	19,577.46
Sales of publications		1,072.74
Certificates of Membership		193.25
Advertisements		431.00
Interest on invested funds		830.44
1 Fellowship fee		150.00
New Building fund subscriptions		1,800.00
Compounding of dues		650.00
Subscription to Library		50.00
Total receipts		$29,056.89
		$35,562.41

Disbursements.

Interest on Mortgage	$ 800.00	
Taxes	483.83	
Publications	10,508.85	
Stationery and Printing	1,233.82	
Postage	1,543.85	
Library	814.05	
Salaries	3,000.00	
Convention and Annual Meeting	1,417.27	
Janitor, House Supplies, fuel Water and Gas	1,724.22	
Certificates of Membership	138.45	
Insurance	71.88	
Norman Medal and Rowland Prize	120.50	
Finance Treasurer's Books, General Accounts—Collections	1,200.00	
Work of Committees	467.00	
Other Expenditures	418.23	23,941.95
Purchase of Bonds for Building Fund		5,075.00
Transferred to Savings Bank		30.44
Balance on Hand		
Building Fund	1,919.50	
General Funds	4,595.52	6,515.02
		$35,562.41

INVESTED FUNDS OF THE SOCIETY.

Fellowship fund	$11,488
Building fund	17,842
New building fund	8,030
Norman and Rowland prize funds	2,222
General fund	1,184
Compounding fund	1,650
Total Dec. 31, 1888	$42,416

The increase fr m last year is about $9,000, chiefly in the new building fund.

The Building Committee reported that $150,000 is needed for the proposed new building, and as it will be some time before this large sum can be raised, it has been decided to build an extension at the rear of the present house at a cost of about $8,000. The plans have been prepared by Mr. HATCH and accepted, and the work is expected to be finished within the next 5 or 6 months.

With regard to the trip to Europe, about 125 members have stated their intention of going, and several others state that that they may go. It was decided that the President should appoint a committee of three to make arrangements. A very large number of places were suggested for the next annual convention, but it was resolved that this be decided by the incoming board of Directors.

The report of the Committee on Uniform Standard Time was read by Mr. SANDFORD FLEMING; the committee was requested to seek the coöperation of the General Time Convention and was authorized to take such steps as may be approved by the Board of Direction, to bring the subject to the attention of the schools of the country. Mr. FRED BROOKS was appointed a member of this committee.

Mr. FRANCIS COLLINGWOOD reported progress by the Committee on Compressive Strength of Cement. He stated that the committee had no report to present beyond that presented at the last convention, and that while the work of collecting information, etc., had been practically completed, it was now necessary that a large number of careful and continuous tests should be made. The committee was continued.

The committee on the Proper Relation to Each Other of the Sections of Railway Wheels and Rails also reported progress. Mr. DON. J. WHITTEMORE read an interesting paper on the subject, in which he advocated a flat topped rail, an improved design, and better manufacture. Some discussion followed the reading of this paper, of which we shall give a fuller abstract later.

The Norman medal was awarded to the paper on "English Railroad Track," by Mr. E. E. RUSSELL TRATMAN, of the editorial staff of this journal.

The Rowland prize was awarded to the paper on "The Venturi Water Meter," by Mr. CLEMENS HERSCHEL, of Holyoke, Mass.

The following officers were elected for the current year:

President; MAX J. BECKER, by 311 votes, against 282 for THOS. C. CLARKE, the opposition candidate.
Vice Presidents; ALPHONSE FTELEY, E. L. CORTHELL.
Secretary and Librarian; JOHN BOGART.
Treasurer; GEORGE S. GREENE, Jr.
Directors; CHAS. B. BRUSH, ELLIOT C. CLARKE; WALTER KATTE, ROBT. E. MCMATH, WM. P. SHINN.

Engineers' Club of Philadelphia.—The eleventh annual meeting was held on Jan. 12; President JOSEPH M. WILSON in the chair, 60 members and 2 visitors present.

The Secretary and Treasurer reports receipts for the year 1888, $4,150.62, and expenditures, $4,032.09; the balance on hand, including $586.48 transferred from 1887, is $714.00. Other assets than this balance amount to $1,739.54; so that the net assets are $2,453.55, these not including unpaid dues for 1889 or the library and furniture.

The membership stands as follows: Honorary Members, 2; Active, 497; Associates, 13; total, 512. During 1888, 52 Active and 5 Associate Members were elected and there were 2 deaths and 18 resignations. The net increase in active membership was about 8½ per cent. for the year. The active list has 229 Philadelphia members; 105 in other parts of Pennsylvania; New York, 34; Virginia, 24; New Jersey, 21, and the remaining 84 are widely scattered.

The President called attention to prospective efforts to interfere with the excellent organization of the U. S. Coast and Geodetic Survey. Prof. ARTHUR BEARDSLEY presented a preamble and resolutions urging upon the Government the great importance and desirability of maintaining both the present status of the Survey, and the methods by which its management is selected. Prof. L. M. HAUPT seconded these resolutions, and after discussion they were adopted.

The retiring President, Mr. JOSEPH M. WILSON, delivered the annual address, which was devoted to an historical account of bridges from the earliest times on record to the present day. A large number of the more notable constructions, in wood, stone, iron and steel, were specifically mentioned. Some account was given of the history of the manufacture of iron and steel, and their particular advantages in bridge construction, resulting in their almost universal use for the building of the permanent bridges of the present day. Questions of failures were also considered, and suggestions made in reference to this subject.

The following officers for 1889 were elected: President, WM. SELLERS; Vice President, Prof. ARTHUR BEARDSLEY; Secretary and Treasurer, HOWARD MURPHY; Directors, T. M. CLEEMANN, FREDERIC GRAFF, Prof. L. M. HAUPT, WASHINGTON JONES, JOS. M. WILSON.

Engineer's Club of St. Louis.—The club met at Washington University January 2, at 8.10 P. M. President MEIER in the chair, 40 members and 4 visitors present.

Mr. ROBT. MOORE, as chairman of a committe appointed for this purpose, reported upon the question of unsafe highway bridges, briefly as follows:—The Committee believe that no improvement over present vicious methods can be looked for until such bridges are brought under the supervision of skilled engineers, and the only practical way is to have the engineer or engineers in charge of similar structures appointed by the State. This procedure would be more economical than individual county action and tend to prevent the selection of incompetent or locally favored men. This State engineer should approve all plans and specifications for bridges exceeding a certain span before erection; and he should appoint a competent inspector on all more important structures, the inspector to be paid by the county. The State engineer should also at once examine and report upon the causes of all failures of highway bridges, locate the responsibility and publish this report in the local papers. In the present state of such work, any general or standard specification for highway bridges would not be proper, owing to the requirements of different localities and the growing state of the art of bridge building. It would be better to leave all such matters to the judgment of the engineer, who will be likely to be over cautious rather than overbold when the full responsibility is upon his shoulders. The general adoption of a scale of minimum charges for the preparation of bridge plans would be convenient to engineers, and facilitate the employment of experts by counties, etc. But the number of members of the various engineering societies who have special experience or interest in bridge work is so small that the committee does not think that these associations are in a position to act intelligently in this matter, nor justified in acting at all. A conference of representatives of various engineering societies, with a view to some united recommendation to the State legislature is deemed good and proper and the St. Louis Club would take part in such conference. The members of this committee were ROBT. MOORE, C. H. SHERMAN and A. W. HUBBARD. The committee was discharged on the reception of the report.

Mr. N. W. EAYRS then read a paper on the "Interlocking System of the St. Louis Bridge and Tunnel Railroad." The present system had been in use since 1883. Three stations were operated, one large one in East St. Louis and two smaller ones in St. Louis. An air compressing plant was operated at the east pier of the bridge. The compressed air was carried to the three stations, where it was used to operate pumps, which maintained a pressure on a second system of pipe work, by means of water in the summer, and a solution of chloride of calcium in the winter. A detailed description was given of the workings of the different parts of the system.

Mr. THOS MCMATH then presented a paper on the "Peculiarities of the Citizens' Cable Railway." This system is quite extensive, some 12 miles being operated in three sections. The paper gave an interesting description of the various types of grips in use, also the dies and the material of which they should be made; method of taking and letting go the cable; also a description of the cable itself, and the method of taking care of it. The author described some improvements of his own which were in successful use. The paper was illustrated by drawings and models.

WM. H. BRYAN, *Secy.*

Engineers' Club of Kansas City.—At the annual meeting the following officers were elected: President, O. B. GUNN; Vice President, W. H. BREITHAUPT; Directors, WYNKOOP KIERSTED and S. H. YONGE; Secretary, KENNETH ALLEN; Treasurer, F. W. TUTTLE; Libarian, FRANK ALLEN.

Michigan Engineering Society.—The annual convention will be held at Lansing, Mich., commencing Jan 22

Montana Society of Civil Engineers.—The following is the general programme for the annual meeting:

Regular meeting to be held Jan. 19, at the office of Mr. E. H. BECKLER, Chief Engineer, Montana Central Ry., at Helena, for the transaction of general business, election of officers and members under ballot. It being the intention at this meeting to dispose of all routine business, that the more interesting features of the annual meeting to occur at Butte may thus be relieved and given sufficient time for their accomplishment. The regular meeting to be adjourned to Jan. 21, to meet at Montana Central Railway depot to take train for Butte, where examinations of mines and other matters of engineering interest will be made until evening, when officers will be installed, professional papers read and discussed, etc. In the evening the annual banquet of the Society will take place.

Iowa Society of Surveyors and Civil Engineers.—On Jan. 9, the county surveyors of Iowa met in convention at Des Moines, and at the same time the civil engineers held a meeting in the same place. The main object of these bodies was to form a consolidation between the two organizations, and committees were appointed for this purpose. The societies met in joint session at the City Council room, and at once proceeded to effect a permanent organization. Officers of the new organization were then elected as follows: Mr. ED. GILCHRIST, of Keokuk, President; SETH DEAN, Secretary; F. A. MCDONALD, Treasurer; M. TSCHIRGI, Dubuque, Vice-President; M. R. LAIRD and CHAS. BENNETT, Directors.

While waiting for the report of the Committee on Constitution, the President, ED. GILCHRIST, read a paper on water-ways. A general discussion of sewer pipes followed the reading of the paper. There was a general expression in favor of the pipe with the long socket, the longer the better and stronger. The report of the Committee on Constitution was then made. The name of the organization is to be the Iowa Society of Surveyors and Civil Engineers. The headquarters of the Society will be at Des Moines.

RAILWAYS.

EAST OF CHICAGO.—Existing Roads.

Williamsport & Binghamton.

MONROETON, Pa., Jan. 10, 1889.

EDITOR ENGINEERING NEWS:—We have nearly completed the final location of this road which is to run from Williamsport, Pa., *via* Loyalsock creek, Forksville, Dushore and Monroeton to Towanda. Thence by Wysox, Wyalusing and Apolacon creeks to the valley of the Susquehanna river near Binghamton, N. Y., a total distance of 110 miles. Work is light. The max. grades are 60 ft. and max. curves 6°. There will be a 1500 ft. bridge at Towanda. Right of way is nearly all secured and the contract for construction has been let to Belden & McTighe, 52 Broadway, New York City; The work is to be completed by Sept. 1, 1890. The company was chartered in February 1888, FRANCIS M. WARD is President.

P. E. ALDEN, *Chief Engineer.*

Freehold & New York.

FREEHOLD, N. J., Jan. 7, 1889.

EDITOR ENGINEERING NEWS.—The Keyport Railroad

has been chartered to build a branch from Keyport to the Lorillard Brick Works, 2½ miles. Right of way is secured and the contract is let to T. C. O'REILLEY of Orange, N. J., who will complete the road in March or April, 1889. EDWARD D. ADAMS, 120 Broadway, is President of the company and W. S. SNEDEN, of Red Bank, N. J., is Chief Engineer.

J. E. RALPH, *Superintendent*.

Grafton & Upton.—Through a clerical error, in making up our record of the construction of 1888, the 4.6 miles laid on this Massachusetts road from Grafton to West Upton, which was reported to us by Chief Engineer H. P. BEAN, was omitted from our record. Surveys have been made from West Upton to Milford, a distance of 8¼ miles, and construction is to begin as early as the weather will permit.

Providence, Webster & Springfield.—A correspondent informs us that 1.06 miles of track was laid on the East Webster branch of this Massachusetts road in 1888.

Deer Creek & Susquehanna.—L. B. McCabe & Bro., of Port Deposit, Md., have secured the contract for this road, and are to break ground by Feb. 15 and finish the work by Sept. 15, 1889.

Newfoundland.—Bids for the construction of the 250 miles of Government railways in this colony, reported last week, will be received up to March 18. Specifications and full particulars can be obtained of Seward, DaCosta & Guthrie, 29 Nassau St., New York City; O'Connor & Hogg, Barristers, Ottawa, Ont.; or of Burn & Berridge, 9 and 10 Pancras Lane, Bucklersbury, London, E. C.

Canadian Pacific.—The company is advertising for bids for grading the Ontario & Quebec extension from London to Detroit, 110 miles. Bids will be received up to noon of Saturday, Jan. 26 by W. C. JENNINGS, Engineer and Manager of Construction, Toronto, Ont.; at whose office plans, profiles, specifications, etc., may now be seen.

West Shore.—The repairs to the West Point tunnel are completed, and trains are now running as usual.

Pittsburg, Shenango & Lake Erie.—The injunction to prohibit the issue of bonds by this Pennsylvania company for the purpose of completing its road, has been dissolved. The suit seems to have been due to some petty personal spite.

Old Colony.—The surveys have been completed for the branch from Walpole to North Attleboro, Mass., 11¼ miles. Right of way is now to be secured, and work will probably begin early in the spring on the grading.

Pennsylvania.—It is reported that work is to be resumed on the Turtle Creek Valley road.——Grading is in progress on the Unity extension of the Southwest Pennsylvania road.

Philadelphia, Newtown & New York.—It is reported that the Baltimore & Ohio intends to secure this road and extend it across New Jersey to gain an independent line to New York. The line now forms part of the Reading system.

Lake Shore & Michigan Southern.—According to the Cleveland *Leader*, it has been determined to build a Vanderbilt branch from Cleveland to Youngstown, parallel to the Nypano.

Grand Trunk.—The company proposes to construct a branch from Stoney Creek Station, Ont., on the Great Western division, to a point on the Northern & Northwestern division near Hamilton Beach.

Canada & St. Louis.—It is reported that this Michigan company is soon to purchase the Toledo, Saginaw & Mackinaw road, running from East Saginaw to Durand, and will use it as a part of its main line. The division just completed from West Bay City to Midland would then be extended north.

Philadelphia & Reading.—The annual report of this company for 1888 shows as follows:

	1887	1888
Gross earnings	$41,188,736	$39,638,989
Operating expenses	28,758,683	29,961,001
Net earnings	12,430,053	9,677,988

During the year the company transported 15,975,830 passengers, 8,713,375 tons of general merchandise, and 10,112,448 gross tons of coal.

Columbus, Lima & Northwestern.—A company was organised at Sturgis, Mich., on Jan. 12, under the name Sturgis, Indiana & Ohio, to build the extension of this road from Bryan, O., *via* Sturgis to South Haven, Mich

Old Colony.—It is rumored that this company is negotiating for the lease of the Northern Railroad of New Hampshire, and that it is contemplated to gain control also of the Boston, Concord & Montreal, the Fitchburg and the Cheshire roads. The story is probably a piece of pure fiction.

Philadelphia & Reading.—Grading has begun for additional tracks at Reading to accomodate the increased freight traffic. A belt line is also contemplated. The paint shop destroyed by the recent cyclone will be rebuilt at once.

Flint & Pere Marquette.—Chief Engineer WM. B. SEARS sends us the following report of tracklaying on this Michigan road during 1888: Belt lines at South Saginaw and Bay City, 8.11 miles. Coleman to South Cedar, 3.55 miles. Besides this, 24.69 miles were laid on sidings and logging spurs.

Projects and Surveys.

Titusville, Cambridge & Lake Erie.

TITUSVILLE, Pa. Jan. 9, 1889.

EDITOR ENGINEERING NEWS.—This road is to run from Pleasantville, Venango county, Pa., *via* Enterprise, Titusville, Cambridge and Edinboro to the city and harbor of Erie, a distance of 65 miles. Grading and masonry work is completed from Enterprise to Cambridge. The enterprise is projected in the interest of the New York, Lake Erie & Western. The company was incorporated March 21, 1887. F. P. JAMES of Titusville, Pa., is chief engineer.

A. H. STEEL, *President*.

Clarksville & Voorheesville.—A meeting was held at Clarksville, N. Y., on Jan. 12 to consider a proposed railway from that town to some point on the West Shore road. THOS. CANT, JOSEPH ALLEN and PETER FLAGLER were appointed a committee to engage an engineer to survey the line and report on its possibility; and subscriptions were made to defray the expenses of the survey.

Buffalo & Williamsville.—

BUFFALO, N. Y., Jan. 11, 1889.

EDITOR ENGINEERING NEWS:—The survey for this road, which is to run from Buffalo to Pine Hill and Williamsville, a distance of about 10 miles, will begin about the first of April, 1889. Work is medium. Right of way is partly obtained and the contract for construction is let to Crocker, Pearson & McIntire, of Buffalo. Tracklaying will probably begin about June 1, 1889, and the road be opened for traffic by September. The company was incorporated March 25, 1886.

B. J. TILLMAN, *President*.

Rockland, Rockport & Camden.—

ROCKLAND, Me., Jan. 10, 1889.

EDITOR ENGINEERING NEWS:—The preliminary survey for this road, which is to run from Rockland to Camden through Rockport Village, a distance of 8½ miles, was made in 1887. There is considerable light rock work and wooden trestling, grades generally easy; maximum curve about 12°. No local aid has been obtained. P. J. CARLETON, of Rockport, Me., is President. The company was organized in 1887.

O. H. TRIPP, *Chief Engineer*.

Northern Michigan.—

HANCOCK, Mich. Jan. 10, 1889.

EDITOR ENGINEERING NEWS:—The preliminary survey for the Northern Michigan Railroad, which is to run from Houghton southwest in nearly a direct line to Watersmeet, a distance of 70 miles, will be completed about the first of February. The route is through a district rich in mines of copper, coal and iron ore and forests of pine and hardwood timber. Work is light: grades will not exceed 1 per cent. except for the first two miles out of Houghton where they will be somewhat heavier. Right of way has been promised for the greater part of the distance, and important land subsidies have been promised by private owners. The capital stock of $1,000,000 has all been subscribed. Contracts will probably be let by April, 1889. The company was incorporated Oct. 12, 1888. CHARLES S. ROBINSON of Hancock, Mich. is chief engineer. C. A. WRIGHT, *Vice Pres't and Gen. Manager*.

Lake Michigan & Washington.—Capitalists of Michigan, Ohio, West Virginia and Pennsylvania are seeking incorporation for the purpose of building a line of rail road from some point on Lake Michigan throug the state of Ohio entering the towns of Fulton, Huron, Tuscarawas, Harrison and Jefferson, to the Ohio River, thence to Washington, Pa. It is stated that surveyors will be sent out as soon as weather permits.

Kinderhook & Hudson.—Incorporated in New York to build a road from Kinderhook station on the Boston & Albany R. R., *via* Valatie, Stuyvestant Falls, Stockport and Stottville to Hudson, a distance of 16¼ miles. Among the incorporators are GEO. B. PHELPS, J. R. PAWLING and H. H. RICE of Watertown and R. H. HUNTINGTON of Adams.

Canada.—The following companies are seeking incorporation: Hammond River & Moncton, Prince Edward Island & Continental, and River Credit Loop Line.

Jefferson & Columbiana.—A company by this name has been chartered in Ohio to build a railroad from Portland to Steubenville, a distance of 15 miles. The enterprise is backed by the Wheeling & Lake Erie R. R.——The Steubenville Construction Co. has been organized for the purpose of promoting the enterprise. W. B. DONALDSON is President, WINFIELD SCOTT is Vice-President, and GEO. A. MAXWELL Treasurer, all of Steubenville, O.

New York & Boston Inland.—This company, the successor to the New York & Boston Air Line which did a great deal of work on the projected road from Boston to New York in 1887, is before the Massachusetts legislature asking for an extension of the time for the completion of its road to April 1, 1892. Treasurer THAYER stated that the company had already expended $157,000 in Massachusetts and $200,000 in New York, and had let contracts for 40 miles of its line in Connecticut.

West Chester & Lenape.

WILMINGTON, Del., Jan. 9, 1889.

EDITOR ENGINEERING NEWS:—The Board of Trade of West Chester has requested me to ascertain the most feasible route for a railroad between West Chester and Lenape, and I have a party at present on preliminary work. When I have located a line and made my report, it will be for the above named board to consider the subject of organization and construction.

F. L. HILLS, *Chief Engineer*.

SOUTHERN—Existing Roads.

Charleston, Cincinnati & Chicago.—At the election held at Charlotte, N. C., on Jan. 10, the proposition to subscribe $200,000 to aid four railway projects was defeated. It is now proposed to hold a second election to vote $100,000 to this company for the construction of a branch to Charlotte, and it is thought that this proposition can be carried.

Richmond & Chesapeake.—This company, which began the work of building a tunnel under Eight Street in the city of Richmond a few weeks ago, is still involved in difficulties. It is thought that the company will soon be reorganized so that work can proceed.

Ohio Valley.—It is reported that work on the Hopkinsville extension of this Kentucky road has been stopped. The workmen who have been employed there will go to work on the Owensboro & Falls of Rough road.

Louisville, St. Louis & Texas.—The division between Owensboro and Henderson was opened for traffic on Jan. 12.

Savannah, Americus, & Montgomery.—This is the new title of the old Americus, Preston & Lumpkin railroad of Georgia. The company is asking for a charter from the Alabama legislature for the extension which it has surveyed to Montgomery, Ala.

Carolina, Knoxville & Western.—The financial collapse of this South Carolina company appears to be a thorough one. The Georgia Construction & Investment Company which was building the road has also succumbed and CHAS. Z. MCCORD of Augusta and JAS. T. WILLIAMS of Greenville were appointed Receivers.

Knoxville Southern.—About 14 miles have been graded on the northern end of this road and contracts for the remaining 90 miles from Blue Ridge, Ga., to the Tennessee river, were let on Jan. 12.

Chowan & Southern.—Contracts were let on Jan. 15 for the terminal improvements at Norfolk Harbor, including 28,000 lin. ft. of wharves, 130,000 cu. yds. of dredging and 6 warehouses. Work on the main line is maki g steady progress. G. M. SERPELL is General Manager and Chief Engineer, with office at 100 Main St., Norfolk, Va.

Atlantic Coast Line.—The extension of the Albemarle & Raleigh R. R., from Williamston to Plymouth, N. C., is under construction and it is proposed to extend it farther into Hyde county. The Scotland Neck branch will reach Greenville in the spring and will be pushed on to Kinston and Jacksonville, Onslow county.

Carolina, Cumberland Gap & Chicago.—Col. JAS. G. GIBBES has made a report to the Charleston Chamber of Commerce on the special survey made by him of the proposed route of this road from Aiken, S. C., to Asheville, N. C., about 240 miles. The line from Aiken to Edgefield, 27 miles, has been completed and is now in operation. From Edgefield to Pickens, about 125 miles, a great portion of the grading was completed some years ago. The work here is very light and grades are easy. From Pickens to the French Broad river 35½ miles, the line crosses the mountains *via* Moseley's and Eastatoe Gaps, and the work is very heavy, requiring considerable masonry, rock cutting, culverts and trestling. The location has been made with maximum grades of 80 ft. per mile. The estimated cost of this division is $1,010.38 or $28,452 per mile. The line from the French Broad river to Asheville, 41 miles, is favorable for construction and can be built for about $7,959 per mile. The entire line from Aiken to Asheville can be constructed for less than $12,000 per mile, exclusive of equipment.

Jacksonville, Tampa & Key West.—Construction is in progress on the extension from Astor to Eldridge, to connect the St. John's & Lake Eustis Railway with the main line.

Projects and Surveys.

Mobile, Jeakson & Kansas City.—

MOBILE, Ala., Jan. 7, 1889.

EDITOR ENGINEERING NEWS:—The Mobile, Jackson & Kansas City Railroad Co., organized in Alabama and Mississippi, will put into the field on the 15th inst., Engineering party No. 1 for the purpose of locating that part of their line extending from the city of Mobile to Jackson, Miss. The line will run through the finest belt of unculled pine land in the south, at present almost a *terra incognita* to Mobile and the outer world. Line will admit of light grades and few curves and will tap two main lines of road running north out of New Orleans. When completed to its connections northwest it will present the shortest line by 150 miles from Kansas City to Mobile, or the southeast seaboard. The enterprise is fathered by strong capital from Kansas City, Chicago, Jackson and Mobile, and with a clear appreciation of the commercial advantages to accrue from its construction there is little doubt that it will be pushed. The present company has absorbed all that remained of the old Mobile & North western, and starts out of Mobile with 15 miles of road bed constructed, which takes the line over some of the heaviest country on the route contemplated. It is the intention of the management to place the first 15 miles of road-bed in completed condition at an early date. F. A. LEELING, President; H. AUSTILL, Vice President and General Manager; R. B. OWEN, Secretary, and J. W. NICOL, Chief Engineer, are the active officers of the road.

J. W. NICOL, *Chief Engineer*.

Mississippi River & Mexican Gulf.—At a recent meeting of the business men of Wesson, Miss., $62,000 was subscribed toward this enterprise. The line is projected to run from Vicksburg or Natchez *via* Wesson to Meridian or Mobile, according to which city offers the greatest bonus. The officers are JOHN P. RICHARDSON, President; WM. OLIVER, Vice President; LUTHER SEXTON, Secretary and General Manager; the headquarters are at Wesson. Surveys are to begin in a few weeks.

Luverne, Andalusia & Pensacola.—Incorporated in Alabama to build a line of railroad from Luverne, Ala., to Pensacola, Fla. Among the incorporators are JOSEPH S. PRESTWOOD, JOHN F. THOMAS, T. W. STRAUGHN, E. J. MANCELL and others of Covington county, Ala.

Black Diamond.—The stockholders have ordered a mortgage of $12,000,000 to be executed on their proposed road for the construction of a line from Parkersburg, W. Va., to Clifton Forge, Va., ALBERT E. BOONE, of Zanesville, O., is the chief projector.

Pensacola & Memphis.—The locating survey of this road has been completed from Memphis to Pensacola, a distance of 450 miles.

Henderson & State Line.—Meetings are to be held in McLean county, Ky., to consider the proposition to take $40,000 of stock in this proposed road. The company has joined forces with the Henderson & Bowling Green Co.

Georgia.—Bills have passed the Legislature to incorporate the following companies: Fairmont & Augusta; Macon & Birmingham; Mountain Valley; Georgia Overland R. R. & Improvement Co.; Cleveland; Millen, Mt. Vernon & Florida; and the Nacoochee Valley.

Roanoke & Craig.—The affairs of this road, contracts for the construction of which were let to F. J. Chapman & Co. in May of last year, have been taken in hand by new parties. At a meeting of stockholders, recently held, it was decided to build the road from Roanoke *via* Newcastle to Eagle Rock, a distance of 48 miles, and contracts were let to the Sears Construction Co. of Chattanooga, Tenn. The route is through a fine mineral region in which iron, manganese, slate, marble and coal are found in abundance. J. W. MARSHALL is President and M. M. ROGERS of Roanoke, Va., is interested.

THE NORTHWEST—Existing Roads.

Chicago & Northwestern.—The proposed extension from Janesville, Wis., to Geneva, noted last week, has been placed under survey.

Duluth & Winnipeg.—This company is obstructed in obtaining possession of its land grant by the St. Paul Brainerd & Northwestern company, which has brought suit, claiming that the legal title thereto cannot lie with the Duluth & Winnipeg as it has not complied with the conditions.——Duluth dispatches state that GEORGE B. BAKER and E. K. HIGHT of Baltimore are at the head of a construction company which will finish the line.

Illinois Central.—The old rumor is again in circulation that this company has taken up the Wisconsin Midland enterprise and will push an extension north from Madison to Fond du Lac and Sturgeon Bay. Whether there is any more foundation to the report than usual, is not known.

Deadwood Central.—Surveys are soon to begin for the extension to the Hay creek coal fields.

Burlington & Missouri River.—It is stated that a northwestern extension has been located to Deadwood, Dak.

Northern Pacific & Manitoba.—Tracklaying on the Portage extension has been resumed. The Canadian Pacific men have removed the barricade and dead engine, and no further obstacle exists to the crossing of the new line.

Winona & Southwestern.—Work is making good progress on the surveys of the line in Iowa. The location to Mason City is completed and work is in progress between Ft. Dodge and Omaha.

St. Joseph & Grand Island.—This company has leased of the Union Pacific 37 miles of the Omaha & Republican Valley road from Valley to Valparaiso.

Chicago, Burlington & Quincy.—The formal ending of the great strike is welcome both to the company and the Engineers' Brotherhood.

Projects and Surveys.

St. Ignace & Sault Ste. Marie.—The chief engineer of this road, Mr. GEORGE COX, writes us that the locating survey will commence about the first of February. The projected length of the road is 53 miles. WILLIAM CHANDLER of Sault Ste. Marie is President.

Milwaukee & Wauwatosa Motor.—

MILWAUKEE, Wis. Jan. 11, 1889.

EDITOR ENGINEERING NEWS:—The Milwaukee & Wauwatosa is to be a motor road carrying passengers only. It will run from Milwaukee to Wauwatosa, a distance of three miles. The route has been surveyed and runs through residence property affording very easy grades. There will be one viaduct 1,000 ft. long. The road is expected to be open for traffic by July 1, 1889. GUSTAV STIENHAGEN is chief engineer. W. S. JOHNSON.

Minneapolis, St. Paul & Superior.—This company has been incorporated to build a line of railway from Superior to St. Croix Falls, a distance of 95 miles, with a branch toward the south. Among the directors are E. L. JOHNSON of Superior and ISAAC STAPLES of Still water.

Canada.—A correspondent of the *Railway Review* gives the names of the following companies, in the Canadian Northwest, which will ask for incorporation at the coming session of parliament: The Assiniboine, Edmonton & Unjiga; the Northwestern & Lake of the the Woods; the Red Deer Valley; the Calgary, Alberta & Montana. In addition parliament will be asked to extend the time for the commencement of construction on the Winnipeg & Northern Pacific for three years beyond the time specified in their charter, and to reduce the number of miles to be constructed each year to 20 miles. The Belleville & Lake Nipissing Co. also ask for extension of time and power to increase their capital stock.

Alberta & Athabasca.—Mr. C. S. DRUMMOND, accompanied by a representation of Lucus & Aird, railway contractors, has left Winnipeg on a tour of inspection of the Wood Mountain & Qu' Appelle and the Alberta & Athabasca railways. If his report is favorable, it is said that the above contractors will undertake the construction of both roads next season.

Brandon, Souris City & Rock Lake.—Incorporated in Canada to build a road from Brandon in a southeasterly direction, *via* Souris City and Rock Lake, to the International boundary.

Pacific Short Line.—A press report from Sioux City, Ia., states that contracts have been let for grading a road from Salt Lake City to Los Angeles, Cal., which is to be the western connection of this proposed li e.——At the office of the Wyoming Improvement Company in the Equitable building, this city, which represents the Pacific Short Line project here, all information regarding the company's affairs, prospects and plans is refused.

THE SOUTHWEST—Existing Roads

Williamsville, Greenville & Northeastern.—This Missouri company has reported 6 miles of track laid in 1888. A. L. BOWEN of Williamsville is Chief Engineer.

Chicago, Milwaukee & St. Paul.—It is reported that the company has recently been making surveys for a belt line about Kansas City. The scheme would necessitate the construction of a bridge at Wyandotte.

Memphis, Little Rock & Indian Territory.—Construction is at a standstill on this Arkansas road on account of financial difficulties.

Missouri Pacific.—The Kansas & Arkansas Valley Co. has filed at Tahlequah, Ind. Ter., a map of the surveyed route for the extension from Wagoner, Ind. Ter., to Coffeyville, Kan. It is stated that grading is to begin at an early date.

Denison & Washita Valley.—The engineer corps of this company has been instructed to cross-section 10 miles of the line from Lehigh, Ind. Ter., on which it is proposed to begin grading at once.

Atchison, Topeka & Santa Fé.—At the directors' meeting in Boston on Jan. 15, it was voted to pass the quarterly dividend. Since 1879 the company has paid steady dividends of about 6 per cent., amounting in all to 56½ per cent, besides a stock dividend of 50 per cent. in 1882. The passing of the dividend had little effect on the price of the stock, which, except for the uncertainty regarding the company's actual financial standing, would certainly sell much higher. A statement of the company's standing is promised in February.

ROCKY MT. AND PAC.—Existing Roads.

Southern Pacific.—The corrected record of the tracklaying on this system during 1888, just received from the Chief Engineer's office, shows a total of 232.9 miles instead of 237.7 as reported in our list of Dec. 29. The lines built in southern California were from Studebaker to Whittier, 5.9 miles; San Pedro to outer harbor, 2.9 miles; and Anaheim to Tustin, 11.7 miles. On the extension from Templeton south, track was laid to Santa Margarita, a distance of 10.5 miles. Otherwise the figures were substantially as given in our summary.

Work is to commence at once on the extension of the Stockton & Tulare road from Oakdale to Sangers. Several shiploads of rails are *en route* and when received tracklaying will be pushed on the San Pablo & Tulare extension in the San Joaquin valley, where the grading is practically completed.

Oregon Pacific.—Work on this road has been suspended for the winter. The rails are laid to a point about 60 miles east of Albany.

Union Pacific.—Surveys by this company continue to be reported from various directions. The Nebraska, Kansas & Colorado extension, recently chartered by the company, is said to have been surveyed to Trinidad, Col., to reach the coal deposits there. In Montana a party was at work all the fall in the Bitter Root valley, and two parties have been working for several weeks between Garrison and Missoula. A large force is still at work in northern California and southern Oregon, and the extension from Frisco, Utah, to southern California has been located. If the obligations of the company to the Government were arranged on a permanent basis, there is little doubt that considerable construction would be at once put under way.

Denver & Rio Grande.—It is reported that McMurtrie & Streeter of Denver have taken the contract for an extension from Glenwood Springs to Riffe Creek, about 25 miles.

Northern Pacific.—Chief Engineer J. W. KENDRICK writes us that a branch from Victor to Grantsdale, Montana, 15.2 miles in length, was accidentally omitted from the report of construction for 1888 recently sent us.——It is proposed to extend the Spokane & Palouse railway to Julietta or Camas Prairie, Idaho, in the spring.

Projects and Surveys.

Trinidad & Salt Lake.—This company has been chartered in Colorado to build a railway from Trinidad to Mesa. The principal office is to be at Trinidad. JOHN A. LINDSEY, JAMES A. PEARSE and DAN A. NOBLE are the incorporators.

Astoria & Albany.—At a meeting of citizens recently held at Albany, Ore., a committee was appointed, with S. E. YOUNG as Chairman, to draw up articles of incorporation and submit the same to the people. The proposed road is to run from Astoria to Albany, connecting with the Oregon Pacific on the north side of the Willamette river and entering Albany over that company's tracks.

Green River Valley.—Incorporated in Washington territory to build a road from a point on Green River to Tidewater on Puget Sound, about 25 miles. Among the incorporators are IRA A. TOWN, T. L. NIXON, of Tacoma, C. H. FRENCH and JNO. HOODING.

FOREIGN.

South America.—Messrs. Perkins & Mott of 115 Broadway, this city, are interested in the proposed transcontinental railway from Buenos Ayres across the Argentine Republic and Chili, in which State it will connect with a short road already built to reach the Pacific coast. The firms who obtained the concessions demand $1,000,000 for their privileges.

The railroad will be about 900 miles long. Four tunnels are to be dug through the mountains, the first one at the summit being 2,600 kilometers high. The greater part of the road will run through a prairie country. The governments of Chili and Argentine Republic guarantee an interest of 5 per cent. on $34,000,000 from the time the first 50 kilometers of the road are laid down to the completion of the whole line. The stock of $37,000,000 is nearly all guaranteed, partly by English banking houses and partly by a number of well known New York firms.

The organizing company is composed of railroad building firms, who take stock for the material furnished. Those who subscribe ready money receive first mortgage bonds on the road itself. The representative of Perkins & Mott of this city, DANIEL E. DAVENPORT of London, is now arranging details with the English subscribers. The South American governments show every desire to have the enterprise completed, and travelers landing on the east coast of the continent will soon be able to take a through line to the Pacific Ocean.

Mexico.—Work began Jan. 7 on the road which is to run from Salamanca to Valle Santiago, State of Guanajuato. The company has a subsidy from the State Government.

RAPID TRANSIT.

Street Railways.—***Troy, N. Y.***—The Troy & Lansingburg Street Ry. Co. will abandon its Cohoes and Waterford division at the expiration of its lease in August.

Ashland, Ky.—The Ashland & Catlettsburg Street Ry. Co. will commence work on its line soon.

San Antonio, Tex.—The San Antonio Rapid Transit Street Ry. Co. has been incorporated. Capital stock, $200,000.

Orangeburg, S. C.—The Orangeburg Street Ry. Co. will build 1½ miles of road, but no contracts have yet been let. Address J. W. LOWMAN.

Dummy Lines.—***Nashville, Tenn.***—The Union Railway Co. has been organized to build a dummy line. President, HORACE SCOTT, Louisville, Ky.

Chattanooga, Tenn.—The Cameron Hill & Park Railway Co. will build a dummy line. Work will be commenced in the spring. Address John R. Dean.

Electric Railways.—***St. Joseph, Mo.***—The Wyatt Park line, about 2½ miles long, was opened Jan. 4.

Newark, O.—Poles are being erected for the electric line on Bloomfield Ave. The Daft system is to be adopted and the power will be supplied by the Schuyler Electric Light Co. There will be 4 cars. CHARLES F. BEERS, Superintendent of the Schuyler Electric Light Co., is in charge of the work.

New York, N. Y.—The North & East River Ry. Co. is laying the conduits for the electric line (Bentley-Knight system) on Fulton street. The conduits are laid in the space between the two tracks.

The Joliet Light, Power & Transit Co. has been incorporated at Joliet, Ill., to put in electric light plant and to build and operate cable or electric street railways in that city.

CONTRACTING.

Stone.—The following proposals for $15,000 worth of stone for Beaufort harbor, S. C., were opened Jan. 9 by Capt. W. H. BIXBY, U. S. Engineer Office, Wilmington, N. C.: Chas. P. Dey, Beaufort, $3.23 per ton; Kelley E. Terry, Stella, N. C., $3.07; Francis H. Smith, New York, $2.19.

The following proposals have been received for the breakwater at San Luis Obispo, Cal.: Rudolph Axman, San Diego, $3.44; American Bridge & Building Co., San Francisco, $3.45; San Francisco Bridge Co., $3.69.

Surveying.—The following were the bids received by the City Register, Baltimore, Md., for surveying and platting the territory annexed to the city: W. W. Thompson, Baltimore, $4,350; Hill & Stout, New Brunswick, N. J., $4,945; W. A. Shipley, Baltimore, $9,900; Wm. P. Twamley, Baltimore, $18,500. The contract was awarded to W. W. Thompson.

Piles, Stone, Etc.—Contracts were awarded on Jan. 5 by Major A. M. MILLER, U. S. Engineer Office, St. Louis, Mo., as follows: Nathan W. Tucker, Parkersburg, W. Va.: piles: 5 cts. per ft. for 30 to 35 ft. long, 5½ cts. for, 35 to 40 ft., 6 cts. for 40 to 45 ft.; 6½ cts. for 46 to 50 ft.

7 cts. for 50 to 60 ft. Harry E. Coffin, Memphis, Tenn.; wire, 3 cts. per lb.; screw bolts, 2.33 cts. per lb. W. L. Fox & Co., St. Louis; manila rope, 13.6 cts. per lb.; nails and spikes, 1.94 and 2.68 cts. per lb. Grafton Quarry Co.; St. Louis; stone, 40 cts. per yd.

Pipe.—The following proposals for cast iron pipe have been received by ROBT. K. MARTIN, Chief Engineer of the Water Dept., Baltimore, Md.: Gloucester Iron Works., Gloucester City, N. J., 1¼-in., 9½ cts. per ft.; 2-in., 15 cts.; 3-in., 18¾ cts.; 4-in., 23½ cts.; 10-in., 73 cts.; 12-in., $1.05, all per ft.; 30 and 36-in., $25.99 and $26.99 per ton. H. D. Wood & Co., Philadelphia; 9½, 14.9, 18, 26¼, 70 cts. and $1.05 per ft.; for 1¼ to 12-in., $26.60 and $27.47 per ton. McNeal Pipe & Foundry Co., Burlington, N. J.; 9.26, 16.68, 18.42, 27.7, 71.25 cts. and $1.08 per ft.; $27 and $27 per ton. Addyston Pipe & Steel Co., Cincinnati, O.; 9,62 16.93, 18.550, 27.672, 73.34 cts. and $1.15,$^{57}_{100}$ per ft.; $27.60 and $28.60 per ton; Donaldson Iron Co., Philadelphia; 18.9, 27, 72 cts. and $1.09½ for 3, 4, 10 and 12-in. Meilert Foundry & Machine Co., Reading, Pa.; 19, 27, 72 cts. and $1.10 per ft. for 3 to 12-in.; $28 and $28 per ton. The contract was awarded to the Gloucester Iron Works.

Dam and Dike.—The following proposals for constructing Dam No 8 in Monongahela river were opened Jan. 8 by Lieut. Col. WM. E. MERRILL, U. S. Engineer Office, Cincinnati, O.: C. I. McDonald, Pittsburg, Pa.: oak timber, $24 per M.; drift bolts, 4 cts. per lb.; spikes, 4 cts. per lb.; rip rap stone, $1.17 per cu. yd.; gravel backing, $1 per cu. yd.; total, $38,727.08. Andrew N. McDonald, Coraopolis, Pa.; oak, $31.75; bolts and spikes, 5½ and 4½ cts.; stone and gravel, 98 and 60 cts.; $42,668.75. Hoag & Pettitdidier, Pittsburg; oak, $28; bolts and spikes, 4 cts.; stone and gravel, $1.58 and 35 cts.; $44,030.78. J. R. King & Co., Belpre, O.; oak, $45; bolts and spikes, 5 cts.; stone and gravel, $1 and 75 cts.; $53,453.35. Free & Meredith Construction Co., Pittsburg; oak, $50; bolt and spikes, 4 and 4 cts.; stone and gravel, $2; $71,879.06.

The following proposals for constructing a dike at Red Bank creek, Allegheny river, were also opened by Lieut. Col. MERRILL, on Jan. 8: John J. Shipman, Washington, D. C.; oak and hemlock timber, $24 and $19.50 per M.; riprap stone, 93 cts. per cu. yd.; paving, $1.10 per square; drift bolts and spikes, 4 and 6 cts. per lb.; total, $13,783.95. Joshua R. King, Belpre, O.; timber, $28, $30; stone and paving, 90 cts., $1.50; bolts and spikes, 4 cts., $14,398.21. Andrew N. McDonald, Coraopolis, Pa.; timber, $27.75, $18; stone and paving, 90 cts., $5.33; bolts and spikes, 4½ cts.; $15,035.93. I. V. Hoag, Jr., Pittsburg; timber, $23 and $19; stone and paving, $1.25, $1.05; bolts and spikes, 3 cts. $15,467.60. John F. King, Belpre, O.; timber, $27 and $20; stone, $1.33; bolts and spikes, 3½ and 7 cts.; $16,441.80. C. I. McDonald, Pittsburg; timber, $27, $19.50; stone and paving, 90 cts., $7.50; bolts and spikes, 7½ cts.; $16,954.05. Free & Meredith Construction Co., Pittsburg; timber $38 and $30; stone and paving, $1.50, $2; bolts and spikes' 4 cts.; $21,330.30. Weihman & Henry, Kittanning, Pa.; timber, $23.50, $18.50; stone and paving, $1.85, $14.50; bolts and spikes, 3½ and 3½ cts.; $22,151.90. J. L. Long & Co., Freeport, Pa.; timber, $30, $20; stone and paving, $2, $10; bolts and spikes, 10 cts.; $24,982. F. Gwinner, Allegheny, Pa.; timber, $35, $24; stone and paving, $2.20, $14; bolts and spikes, 3½ cts., 4 cts.; $26,500. P. J. Linnon and G. A. Wack, Kittanning, Pa.; timber, $38, $28; stone and paving, $4.50, $15.50; bolts and spikes, 2½ cts. and 3½ cts.; $42,288.95.

Dredging.—The following proposals were opened Jan. 10 by Lieut. Col. JARED A. SMITH, U. S. Engineer Office Portland, Me.: Back Cove, Portland harbor; Edward Moore, Portland, 25 cts. per cu. yd., (awarded contract). ——Lubec channel; A. R. Wright, Portland, 35 cts., (awarded contract.)——Moose-a-Bee bar; A. R. Wright, 40 cts., (awarded contract; Hamilton & Sawyer, Chebeague, 48 cts.——Rockport harbor; E. P. Lovering, Portsmouth, N. H., 20 cts., (awarded contract); Hamilton & Sawyer, 23½ cts.; Moore & Wright, Portland, 26 cts.; Boynton Bros., Boston, Mass., 30 cts.——Camden harbor; E. P. Lovering, 25 cts., (awarded contract); Hamilton & Sawyer, 29 cts.; Moore & Wright, 30 cts.; Boynton Bros., 33 cts.——Penobscot river; Moore & Wright, 55 cts. (awarded contract); Hamilton & Sawyer, 66 cts.; Boynton Bros., 70 cts.——Narraguagus river; A. R. Wright, 20 cts., (awarded contract); Hamilton & Sawyer, 26 cts.——Bellamy river, N. H.; Thomas Symonds, Leominster, Mass. 35 cts., (awarded contract).——York harbor; Thomas Symonds, 75 cts., per cu. yd. for dredging, $15 per cu. yd. for removing ledge; Geo. W. Townsend, Boston, $1, $13.50; Boynton Bros., 80 cts., $17; all bids rejected.

The following proposals were opened Jan. 8 by Major LIVERMORE, U. S. Engineer office, Newport, R. I.: Hyannis harbor, Mass.; Atlantic Dredging Co., Brooklyn, N. Y., 32 cts. per cu. yd.; J. H. Fenner, Jersey City, N. J., 33 cts; W. H. Beard, Brooklyn, N. Y., 35 cts.——Wareham harbor, Mass.; same bidders, 24, 24½ and 30 cts.——New Bedford harbor, Mass.; same bidders, 24, 24½ and 30 cts. ——Newport harbor, R. I., J. H. Fenner, 34½ cts.; W. H. Beard, 35 cts.; Brainard Bros., New York, 35¾ cts.——Pawtucket river, R. I.; Brainard Bros., 35¾ cts.; W. H. Beard, 37 cts.——Providence river, R. I.; Atlantic Dredging Co.; 12½ cts.; W. H. Beard, 14 cts.; Brainard Bros., 15¼ cts.——Pawcatuck river, R. I.; J. H. Fenner, 40 cts., ——Removing Green Jacket shoal, Providence harbor, R. I.; Atlantic Dredging Co., 14 cts.; W. H. Beard, 15 cts.; Brainard Bros., 17 cts.

The following proposals were opened Jan. 7 by Gen. WM. F. SMITH, U. S. Engineer Office, Wilmington, Del.: In Choptank river, Md.; Atlas Dredging Co., Wilmington, Del.; 28 cts. per cu. yd.; Frank J. Somers, Camden, N. J., 30 cts.; American Dredging Co., Philadelphia, 32 cts.; amount available, $7,400.——In Cambridge harbor, Md.; C. T. Caler, Norfolk, Va., 18½ cts.; F. C. Somers, 21 cts; Atlas Dredging Co., 21 cts.; American Dredging Co., 25 cts.; amount available, $4,000.——In Duck creek, Del.; F. C. Somers, 19 cts.; National Dredging Co., Wilmington, Del., 19½ cts.; Atlas Dredging Co., 20 cts.; American Dredging Co., 22 cts.; W. H. Van Patten, Washington, D. C., 30 cts.; amount available, $9,000.

The following proposals were opened by Capt. W. H. BIXBY, U. S. Engineer Office, Wilmington, N. C., Jan. 9: Georgetown harbor, S. C.; P. Sanford Ross, Jersey City, N. J., 22.9 cts. per cu. yd.; A. A. Springs, Georgetown, S. C., 35 cts.——Waterway between Beaufort harbor and New River, N. C.; Alabama Dredging & Jetty Co., Mobile, Ala., 40 cts. per cu. yd., with 3 cts. reduction if awarded one or more additional contracts.——Beaufort harbor, N. C.; C. T. Caler, Norfolk, Va., 37½ cts.; Alabama Dredging & Jetty Co., 41 cts., with 3 cts. reduction as above.——Waterway between Newbern and Beaufort; Alabama Dredging & Jetty Co., 33 cts., with 2½ cts. reduction as above; C. T. Caler, 34 cts.——New river, N. C.; (no bids).

The following proposals have been received by the Docks Commissioners, New York City, for dredging outside of piers from Pier 56 to Pier at E. 3rd St., and at Pier 61, on the East river: Union Dredging Co., 70 and 20 cts. per cu. yd.; Atlantic Dredging Co., 80 and 22 cts.; Chas. DuBois, 79 and 24 cts.

PROPOSALS OPEN.

Bridge.—Iron truss, 50 ft. span. THE BRIDGE COMMITTEE, Kenosha, Wis.

Pipe.—About 500 ft. of 10-in. cast-iron water pipe. MARTIN FINCK, Clerk of Board of Public Works, Jersey City, N. J. January 21.

Bridge.—Superstructure of bridge across the Gowanus canal at Carrol St. JOHN P. ADAMS, Commissioner of City Works, Brooklyn, N. Y. January 22.

Dredging.—Deepening and dredging the channel of the Peconic river, Suffolk Co. JAMES SHANAHAN, Superintendent of Public Works, Albany, N. Y. January 23.

Electric Lighting.—Extent of circuit, 34 miles; capacity of plant, 140 double arc lamps of 2,000 c.p. Plans and specifications on file. C. F. BRAGG, Mayor, Bangor, Me. January 23.

Street Work and Sewers.—THE PARKS COMMISSIONERS, 49-51 Chambers St., New York City. January 23.

Street Work and Sewers.—THE COMMISSIONER OF PUBLIC WORKS, 31 Chambers St., New York City. January 24.

Railway.—Canadian Pacific Railway, Ontario & Quebec Detroit extension. Proposals for grading, etc., on all sections of the company's line between London and the Detroit river, a distance of 110 miles, will be received by the company's engineer. Plans, profiles, specifications, forms of tender and other information may be obtained, W. C. VAN HORNE, President, W. T. JENNINGS, Engineer and Manager of Construction, Toronto, Ont., Canada. January 26.

Cement Sidewalks.—THE CITY CLERK, Los Angeles, Cal. January 81.

Electric Lighting.—For the northern and southern districts. Arc and incandescent lights for streets and public buildings. HENRY FLAD, President, Board of Public Improvements, St. Louis, Mo. February 28.

Railway.—About 250 miles for the Government of Newfoundland. O'CONNOR & HOGG, Ottawa, Ont., Canada. March 18.

GOVERNMENT WORK.

Timber Dry Dock.—Dock, with caisson, pumping plant, culverts, etc., complete; 500 ft. long, 130 ft. wide at top and 50 ft. on bottom, 25 ft. 6 ins. deep on sill, 80 ft. wide at entrance. At League Island navy-yard, D. B. HARMONY, Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C. February 1.

River Improvement.—Removing overhanging trees, snags, logs and bowlders from the channel and banks of the Mississippi logs between Aitkin and Grand Rapids, Minn. Major CHAS. J. ALLEN, U. S. Engineer Office, St. Paul, Minn. February 7.

Rip-Rap Stone.—About 100,000 tons on jetties at Charleston, S. C., Capt. F. V. ABBOTT, U. S. Engineer Office, Charleston, S. C. February 16.

MANUFACTURING & TECHNICAL.

The Richmond Locomotive & Machine Works, Richmond, Va., is extending its works and putting in a large number of new machine tools and plant. The works are to have a capacity to enable them to turn out 100 engines a year.

Car Works.—The Lehigh Car, Wheel & Axle Works, Catasauqua, Pa., have built a new erecting shop 132 x 50 ft. A large order for the Lehigh Valley road is on hand.

The United States Rolling Stock Co., Anniston, Ala., is building additions to its car works.

The St. Charles Car Co., of St. Charles, Mo., will increase its capital stock to $1,000,000; it will build new shops and increase the capacity of its works.

The Haskell & Barker Car Works, Michigan City, Ind., will build a new brick blacksmith shop 164 x 130 ft.

Receiver MCNULTA, of the Wabash road, has leased extensive agricultural works at Springfield, Ill., and will convert the establishment into car shops for the repair work of the western divison.

Broken Stone.—The Chief Engineer of the Board of Public Works, Jersey City, N. J., has submitted specifications for stone for road making. The bottom will be made of stones, no one of which shall be more than 4 ins. deep; on this foundation, laid by the county, there will be 2 ins. of No. 2 or No. 4 broken stone. The latter will be measured after being laid,

The Niagara Meter Co. will build new works in Brooklyn, N. Y., at a cost of $50,000.

Trade at Philadelphia.—Shipbuilding, locomotive, car and bridge building, engineering, machinery all the various interests clustering around Philadelphia report an abundance of orders, so that there is every reason to expect a continued large consumption of iron.

Tube Works are being built at Detroit, Mich., for a company which controls a new patent. The iron roof is being made at the Detroit Bridge & Iron Works.

A Garbage Crematory is to be built at Dallas, Tex. Propositions for its construction have been received by the mayor.

The Altoona Mfg. Co. has been incorporated at Altoona, Pa., to build engines, boilers, cars, etc. Capital stock, $100,000.

The Pintsch System of lighting cars by gas is to be applied by the Safety Car Heating Co. to 58 cars of the Wagner Palace Car Co.

Car Notes.—The Erie Car Works, of Erie, Pa., are building 100 cars for the New York, New Haven & Hartford.

The Lafayette Car Works, of Lafayette, Ind., are building 300 cars for the Lake Shore & Michigan Southern, and 100 refrigerator cars for the Cincinnati, Hamilton & Dayton.

The Pullman Car Co., of Detroit, has built 500 box cars for the Oregon Ry. & Navigation Co.

The Michigan Car Co., of Detroit, is building 200 cars for the Lake Shore & Michigan Southern.

The Barney & Smith Mfg. Co., of Dayton, O., is building some express cars for the Erie road service of Wells, Fargo & Co.

The St. Charles Car Co., of St. Charles, Mo., is building 10 baggage cars for the Chicago & Atlantic.

The U. S. Rolling Stock Co., is building at its works at Anniston, Ala., 60 coke cars for the Alabama Great Southern.

Converting Iron.—A company is to be organized at Hartford, Conn., to work a new process for the conversion of iron; experiments have been in progress for some time at the Woodruff & Bead factory.

Railway Track Material.—A company has been organized at Chicago Ill., by ABRAHAM REESE, of Pittsburg, Pa., with others, to roll old steel rails into smaller rails under patents held by Mr. REESE, and also to manufacture splice-bars, bolts and spikes. Works are to be erected at Hartford City, Ind.

Phillips & Davies have established a factory for railway spikes at Wampum, Pa.

Passenger Cars.—The St. Charles Car Co., of St. Charles Mo., has built 2 vestibule cars for the Kansas City, Fort Scott & Memphis; they are fitted with the Johnson chair. They are also building 2 parlor cars for the Toledo, Ann Arbor & North Michigan.

The Pullman Palace Car Co., of Pullman, Ill., has an order for 30 passenger cars for the Baltimore & Ohio; six will be vestibuled and the others so built that they can be vestibuled afterwards without altering the platforms or ends of the cars. They are to be delivered before March.

The Barney & Smith Mfg. Co., of Dayton, O., has recently delivered 7 drawing-room cars for the New York & New England; 50½ ft. long, 10 ft. wide, 14 ft. high from rails; carried on 4-wheeled trucks with 38-in. wheels.

Osgood, Bradley & Sons, of Worcester, Mass., have an order for 20 cars for the Boston & Maine.

The Harlan & Hollingsworth Co., of Wilmington, Del., is building 40 Mann boudoir cars for the Union Palace Sleeping Car Co.

The Wason Car Mfg. Co., of Brightwood, Mass., has an order for 25 cars for the Old Colony, and 10 for the Argentine Republic.

The car works at Green Cove Springs, Fla., have built 10 cars for the St. Augustine & Jacksonville.

Locomotive, Railroad Supplies, Etc.—A narrow gauge locomotive is wanted, new or second-hand, which will haul 10 or 20 tons of coal up a grade of 4½ per cent. for 600 ft. on a sharp curve. Also 16, 20, 25 or 30 lb. rails. Address "B", *Manufacturers' Record*, Baltimore, Md.

The Automatic Track Layer Construction Co. has been incorporated at Minneapolis, Minn., by S. W. Roberts, L. J. Drennan, S. R. Nettleton, A. C. Houghton and G. L. Watchman. Capital stock, $1,000,000.

The Dunham Mfg. Co., of Boston, Mass., publishes a "scrap book" containing testimonials, press notices and other information regarding the Servia tie plate for protecting railway ties. These plates have been in use since 1886 and have been tried by the Fitchburg, Manhattan (elevated), West Shore, Maine Central, New York & New England, Intercolonial and Canadian Government railways; they are also being largely used in new construction on the Pacific slope, their economy having been very strongly shown in the trials made during the last few months. The "scrap-book" contains some interesting reading matter. The company also supplies the Globe ventilators for cars, and the Reed car replacer, and also manufactures improved freight car doors which are used by a large number of railways.

Steel Works, Foundries, Etc.—The Edgar Thomson Steel Works have had plans and specifications prepared for a foundry and machine shop at Braddock, Pa.

The Union Steel & Iron Co. is building a rolling mill at St. Joseph, Mo.

The Birmingham Mining & Mfg. Co. will issue $300,000 of bonds, and build a 100-ton furnace, steel works and iron works at Gate City, near Birmingham, Ala.

The Montreal Rolling Mills Co., Montreal, will enlarge and improve its mills. S. T. Williams & Co., Philadelphia, are the contracting and consulting engineers.

The Great Western Steel Rolling Mill & Steel Wire Co. will erect a factory at Randolph, near Kansas City, Mo. President, EDWIN A. BEERS, of Springfield, Mo. Capital stock, $200,000. The company will manufacture merchant iron, iron nails, steel wire, iron and steel rods and barb wire, and has a new process for converting old steel rails into steel wire and steel rods, invented by N. S. REYNOLDS, who will have charge of this department.

The Central Iron & Steel Company, of Brazil, Ind., has added a department for the manufacture of turn-buckles used by bridge builders and others. The new department consists of a train of rolls, with the necessary heating furnaces, 4 presses, a special machine, with 6 spindles, to tap the buckles right and left, bolt cutters, lathes, etc.

The West Superior Iron & Steel Co. is building steel works at Duluth. The roof trusses are built by the James P. Witherow Construction Co., of Pittsburg, Pa.

James P. Witherow, engineer and contractor, of Pittsburg, Pa., is bidding on 7 new iron and steel plants to be erected in the south during the next year. These 7 contracts will aggregate over $1,000,000, and will be built by northern capital.

The Phœnix Iron Co. has completed its new plant at Phœnixville, Pa., the plant is expected to turn out steel suitable for armoring cruisers for the Government and for making steel guns of any calibre. It consists of two 15-ton open-hearth furnaces, arranged for additional furnaces when required; one 30-ton ladle crane, two 10-ton ingot cranes and a massive ingot extractor.

A car wheel foundry is being built at Hammond, Ind.; it will have a daily capacity of 200 to 250 wheels. C. A. Treat, of Hannibal, Mo., is one of the promotors.

The Hainsworth Steel Co., recently organized at Pittsburg, Pa., has bought the Bessemer steel plant of the Pittsburg Steel Casting Co. The company will continue the manufacture of car wheels cast from Bessemer steel, which was begun by the Steel Casting Co. These wheels are said to be making satisfactory records in service, while their cost is about half way between that of steel-tired wheels and chilled wheels of the best quality.

Locomotives.—The Taunton Locomotive Works, of Taunton, Mass., have passed into new hands, and are now under the management of the Taunton Locomotive Mfg. Co. New buildings will be erected and new plant put in. WM. R. BILLINGS is General Manager. The works have an order in hand for two switch engines for the Old Colony, 6 wheels coupled, cylinders 17 x 24, weight 90,000 lbs.

The Pittsburg Locomotive Works, of Pittsburg, Pa., have recently built a number of eight-wheel engines for the Louisville, St. Louis & Texas and the Vandalia; some eight-wheel engines for the St. Louis, Alton & Terre Haute; and some engines for the Union Pacific. Also a mogul engine for the Chicago & Calumet; cylinders 19 x 28; driving wheels, 50 ins. diameter; boiler, 64 ins. diameter, of ⅝-in. steel; weight, 120,000 lbs.

H. K. Porter & Co., of Pittsburg, Pa., have shipped six light engines, with 9 x 16 cylinders, to the Argentine Republic. They are building a light plantation engine for exhibition at the Paris Exposition this year.

The Schenectady Locomotive Works, Schenectady, N. Y., have delivered two freight engines for the Charleston, Cincinnati & Chicago. They have a contract for 25 engines for the Union Pacific.

The Baltimore & Ohio is building some consolidation engines at the Baltimore shops; cylinders, 21 x 24; driving wheels, 50 ins.; weight, 134,000 lbs. Three passenger engines are also being built; they are to make 60 miles an hour.

The Housatonic will order 2 passenger engines for the limited express service, and 2 mogul freight engines. All hard coal burners.

The Canadian Pacific is building 10 mogul engines at the Montreal shops, in addition to the 20 recently completed.

The Cleveland, Columbus, Cincinnati & Indianapolis will order several new engines. WM. TURHEFF is Supt. of Rolling Stock.

The Hartman Steel Works, at Beaver Falls, Pa., have been transferred by the Hartman Steel Co., to Carnegie, Phipps & Co., of Pittsburg, and will hereafter be known as the Beaver Falls Mills.

A Good Advertisement of a First Rate Article.—We call your attention to the advertisement in to-day's issue, (on page II) of the National Meter Co., 252 Broadway, New York, which is as novel as it is progressive, and it may seem egotistical on our part when we add that that company not only appreciate the value of taking a page in our paper, in preference to any other, but continue to do so, as an aid to their extensive meter business. On Jan. 6, 1886, they took the outside page of this paper, to announce the fact of their having made and sold 35,000 water meters, a number which at that time seemed to be the "top notch"; either from the effect of that advertisement, or from their indomitable energy, they show by a fac-simile, another anniversary page, which states that within the past three years, they have increased that number 27,000, an average of 750 meters a month, and now reach 62,000, which justly proves one of two things, (or perhaps both), that they manufacture a good water meter, and value the means of putting it on the market, which seems to be verified from an order just received by them from Alameda, Cal., (a copy of which is in their advertisement) for 200 meters, which is in addition to 350 sent to them before.

BRIDGES AND CANALS.

Bridge Notes.—***Salmon Falls, N. H.***—A bridge is to be built by the Boston & Maine Ry. Co.

New Bedford, Mass.—It is proposed to build a second bridge across the Acushnet river to Fairhaven.

Trenton, N. J.—A free bridge over the Delaware river is projected. The cost will be about $30,000.

Harrisburg, Pa.—The Susquehanna river toll bridge, which was built in 1813, is in bad condition and the citizens object to the tolls. It is proposed to erect an iron bridge at a cost of $200,000, and $123,000 have already been subscribed.

Cumberland, Md.—The Cumberland Valley Ry. Co. will build an iron bridge across the B & O. tracks.

Washington, D. C.—The Falls Church & Potomac Ry. Co. has a bill before the U. S. senate to authorize the construction of a bridge over the Potomac river.

Parkersburg, W. Va.—The committee of the Merchants' and Manufacturers' Association recommends the construction of two bridges across the Little Kanawha river. Surveys are being made by engineers FICKINGER and PETTIGREW.

Grafton, W. Va.—A bridge is projected. For particulars address the mayor.

Leitchfield, Ky.—The contracts for the Rough river bridge have been let to the Champion Bridge Co., of Wilmington, O., at $3,650 for the iron work, and to John Moorman, of Falls of Rough, at $2,600 for the stone work.

Wilson, N. C.—P. Linehan & Co. have the contract of the Roanoke river bridge of the Chowan & Southern railway. The piling is about completed and work has been commenced on the masonry.

Cairo, Ill.—Work is in progress on the steel work of the Kentucky approach of the bridge. The foundations for the piers are being put down by Anderson & Barr.

Chicago, Ill.—The new iron draw bridge over the Calumet river, at 106 St., has been completed.

Winona, Minn.—A pontoon bridge is projected by Col. S. N. STEWART; it would cost $30 per ft., or $24,000.

Columbus, Neb.—The new wagon bridge across the Loup river, near Columbus, was opened Jan. 8. It cost $40,000.

Portland, Ore.—The iron spans of the wagon roadway approach to the railway bridge have been completed. A street railway line will probably be laid across the bridge, to connect with the line from East Portland to Albina.

The Flint and Chattahoochee river bridges, for the Alabama Midland road, will be built by the Atlanta Bridge Co., of Atlanta, Ga., Each will have a draw of 230 ft.

The Shenandoah Valley Ry. is replacing its wooden bridges with iron structures.

Canals.—The Chesapeake & Ohio canal, according to the report of President GAMBRILL at the annual meeting at Annapolis, Md., has been maintained in good condition, and during the winter only such repairs will be made as could not be made during navigation.

At Charleston, S. C., there is talk of organizing a company to build a canal to connect the Ashley and Edisto rivers.

Brazos Harbor.—Mr. Wilke, the contractor who built the new State capitol at Austin, Tex., has been examining the mouth of the Brazos river, with a view to putting in a bid for the construction of the proposed deep-water harbor.

WATER AND MUNICIPAL.

Monterey, Cal.—The reservoir is about completed, and the water from Carmel river has been allowed to run into it. It will take about two months to fill it. It covers 33 acres, and when filled will contain over 100,000,000 galls. of water. It was built by the Pacific Improvement Co.

Irrigation.—***California.***—The Redlands Water Co., of Redlands, Cal., has about 25 miles of 5-in. to 14-in. cement pipe. The plan is to deliver water on the highest point of land, say 2½, 5 or 10 acres, at the expense of the company, any subdivision or smaller tracts being piped at the owner's expense under the supervision of the company's superintendent, and under the control of the company. The water is taken onto the land through cement hydrants, and is measured over a weir. The water right is 1 in. to 4 acres each month, and the water can be had when desired. The supply is taken from the Santa Anna river and Bear Valley reservoir through an open cement ditch to the Redlands reservoir whence it enters the cement pipes. The amount required for repairs, etc., and for the superintendent and secretary, the only salaried officers, is raised by assessments on the capital stock. The works were designed by F. E. BROWN, C. E. The officers for 1889 are: President, C. E. OWEN; Vice President E. F. FOOTE; Secretary and Superintendent, C. E. WARREN; Directors, A. S. SAUNDERS, F. P. MORRISON.

Marion, O.—In November, 1888, the City Council enacted an ordinance granting to Howland & Ellis, of Boston, Mass., an exclusive right, for 25 years, to build and operate water-works; at a special election on Dec. 27 this ordinance was ratified by a vote of 615 to 10. The franchise calls for 11 miles of 4 to 16-in. pipe, with 143 double-nozzle fire hydrants, for which the city is to pay $5,280 per annum, or $480 per mile of pipe, and on all extensions it is to pay $300 per mile of pipe, for the use of hydrants located thereon. The supply will be taken from filter galleries by the side of the Little Scioto river, and pumped by two duplex, compound, condensing engines, of 2,500,000 galls. daily capacity each, to a stand-pipe 20 ft. diameter and 120 ft. high. An automatic valve will be placed in the connection between the mains and the stand-pipe, so that direct pressure can be applied when necessary.

Providence, R. I.—The City Council has received a communication from ROBERT CORSCADEN asking that a committee of experts be appointed to investigate the "National" system of sewerage and fertilizer system of treating sewage.

Duluth, Minn.—The city work for the year has been very extensive, and the cost has aggregated about $750,000. The first wood and concrete pavements were laid, covering 43,709 sq. yds. The street improvements covered 21.8 miles. Of storm sewers there were built 10,933 lin. ft. of 12 to 24-in. pipe, 610 ft. of concrete sewer, 4,412 ft. of brick, and 229 ft of tunnel through solid rock. The total length of storm sewers, all built last year, is 3.07 miles, with 119 catch-basins and 69 manholes. Of ordinary sewers there were built 22,450 ft. of 12 to 24-in. pipe and 9,018 ft. of brick. There was added to the sewerage system 4.26 miles, making a total of 12.21 miles. The expenses of the City Engineer's department have been about $25,000 or about 3½ per cent. of the work done.

Drainage of New Orleans, La.—The question of establishing an adequate and efficient drainage system is being agitated, and the City Surveyor has been called upon to furnish plans and estimates of cost for a complete system. The work will consist of ditches and canals, with pumping plant. About $2,000,000 will have to be raised and it is suggested that this be done by a special tax on real estate. The city owns large areas of swamp lands which would be valuable and productive if drained. Estimates have been made by Major HARROD, the City Engineer, as to the cost of constructing the system for a better drainage of the city. The total is put at $961,600. Some of the members of the Water and Drainage Committee are in favor of the permanent improvement of some of the canals and estimates of cost are to be made. Mr. J. JOUET, a surveyor, submitted a plan for draining the city. His idea was to dig a canal in the rear of the city to Lake Borgne, thus, as he claims, securing natural drainage. He estimated that his plan of drainage could be carried out at a cost of $250,000, which sum, he said, would be subscribed by New York capitalists, were his plan adopted. The committee took the matter under advisement, and will submit the plan to the Council.

Santa Ana, Cal.—A report upon the proposed sewerage system has been made by W. R. COATS, C. E. He states that in an ordinary residence city of 15,000 inhabitants, a smooth pipe of 12 ins. internal diameter is large enough to dispose of all sewage that will ever be made; 6 ins. is the proper size for the laterals and 4 ins. for the house connections. The city is very favorably situated for effective sewering, except that it is so far from the sea that a greater first outlay will be necessary on account of the length of the main trunk line. The fall from the city to the sea is nearly 150 ft. The main line will be about 6.7 miles long. For this work an appropriation of $75,000 is recommended, any surplus being used for laterals. Vitrified clay pipe, with cement joints, is the material to be used. An additional $25,000 for 5 miles more of water mains is also recommended.

Brooklyn, N. Y.—The mayor has issued a third message, relating to public improvements and recommending the issue of bonds to the amount of $5,465,000 in addition to the amount required for street paving, a total of $7,965,000. He favors legislation to authorize the issue of bonds for these purposes during 1890 and 1891, bearing interest at the rate of 3 per cent., to be issued in blocks of $400,000 and running 25 to 40 years.

Artesian Wells.—*Savannah, Ga.*—Six more artesian wells are to be sunk. Address ALVIN M. MILLER, Superintendent of Water-Works.

Corinth, Miss.—The city has awarded a contract to B. D. Sory for boring a well.

Dundee, Mich.—The village well is completed; it is 75 ft. in the rock. M. Osborn was the contractor for drilling.

Sparta, Ill.—The City Council will bore for water, and is receiving bids for the work.

Dunlap, Ia.—About a year ago an endeavor was made to have an artesian well sunk, but the project was dropped. For particulars address J. H. SHERMAN, Mayor.

Ashland, Kan.—The town has let a contract for a well; it is to be 700 ft. deep unless a supply of water is met at a less depth.

Saguache, Col.—There are no water-works. An artesian well is being bored by Grosman & Fist, of Monte Vista.

San Pedro, Cal.—The Southern Pacific Ry. Co. has a well down 700 ft. and will supply the town.

Africa.—A well drilling plant and a gang of drillers has been sent out to South Africa by Daniel Dull, of New York, to put down wells for which he has the contract.

Ridgewood Reservoir.—The contract for the new basin at the Ridgewood reservoir, Brooklyn, N. Y., which will double the capacity of the reservoir, has been let to Edward Freel at $293,770. This was the lowest of the 8 bids received, the highest being by Thomas McCann, $434,375. The estimate made by City Engineer VAN BUREN was $450,000 including a gate house, costing about $50,000, which is not included in the present contract.

Water-Works.—*Massachusetts.*—Pittsfield. The Water Commissioners have asked for permission to purchase 4 or 5 miles of pipe to be laid in the spring.——Springfield. The Water Commissioners have asked for an appropriation of $17,000 for pipe, etc., and $13,000 for extending the water system to Brightwood.——Hyde Park. A vote upon the question of purchasing the franchise and plant of the Hyde Park Water Co. was taken on Jan. 9. The result was 201 for and 187 against the purchase, which leaves the property as at present, in the hands of private individuals, a two-thirds vote being necessary to carry through the project of town management.

Connecticut.—New Haven. The New Haven Water Co. has applied to the Legislature for an increase of its capital stock from $1 125,000 to $2,000,000. The company's plan is to build an immense dam at Woodbridge for a reservoir which will contain 300,000,000 galls. The reservoir will be 3 miles from the City Hall. The level of the water in the new reservoir will be 155 ft. above tide water, or 10 ft. higher than the Saltonstall reservoir in East Haven, and 25 ft. higher than the Prospect St. reservoir. The height of the dam will be 45 ft. If desirable, 3 or 4 similar dams will be constructed further up the stream. If only one is built now, others may be added at any time as the city's growth demands, and the supply will be practically inexhaustible. The water mains will be so constructed that the Woodbridge reservoir may be used independently of the others when desired.

New York.—Syracuse. Several schemes were presented to the Water Commission at its recent meeting. The commission has during the 6 months it has been at work, investigated nine sources of supply and gathered a large amount of valuable information. Their report must be filed by Feb. 1.——Poughkeepsie. It is proposed to put in a duplicate pumping plant, at a cost of about $22,000. The filter beds are to be cleaned.——Medina. President JOHNSON of the Village Trustees, has closed a contract with the Bignall Mfg. Co., by which the company is to furnish power for the village water system at $600 per year and an allowance of $100 for every 1,000 ft. of pipe laid.——Castile. The Castile Water-Works Co. has a contract to supply the village with water, and has the pipes partly laid. The estimated cost is $17,000. The mains are of Wyckoff pipe. Aymault Bros. & Co., of Tonawanda, have the contract for building the works complete.

Pennsylvania.—Etna. The works built by the Etna Water Co., which were designed by James H. Harlow & Co., of Pittsburg, were tested on Jan. 8 for the borough authorities by Jacob Schneller, C. E. Four fire streams were thrown 100 ft. high and more than 200 ft. horizontally. There are about 4 miles of pipe, a steel stand-pipe 300 ft. above the town, and the pumping plant is located on the bank of the Allegheny river. Work was commenced in August, 1887, and recently completed.

District of Columbia.—Washington. The residents of Capitol Hill are preparing to make vigorous representations to the commissioners on the subject of the defective supply of water in that section of the city. It is said at the water office that the defects can be cured only by the completion of the tunnel and a reservoir on the edge of the city. The leaders of the Capitol Hill movement urge that they have been wanting water many years, and that the present prospects for the aqueduct tunnel are not such as raise sanguine expectations of the filling of the new reservoir. They think that while they wait for the tunnel completion a stand-pipe on Capitol Hill would obviate many difficulties and silence most of the complaints.

Virginia.—Suffolk. A contract for furnishing a water supply has been awarded. For particulars address the mayor.

Florida.—Gainesville. A franchise for establishing water-works has been granted to J. H. YEATMAN, of Palatka, and Boston capitalists.

Tennessee.—Chattanooga. The City Water Co. has put a large force of men at work on the new 5,000,000 galls. reservoir on Mission ridge; this will give fire protection, by gravity, to all of the business part of the city, and to a considerable part of the suburbs. The company has also ordered a new Worthington high-duty engine of 8,500,000 galls. daily capacity. It is reported that the City Council has appointed a committee to examine as to the feasibility of the city building and owning its own water-works; also to consider a proposition for water supply from the Spring Lake Water Co., Tenn.

Indiana.—Marion. A new pump, built by the Dean Bros. Steam Pump Works, of Indianapolis, was tested and accepted on Dec. 31 and is now supplying the city.

Illinois.—Canton. The city water-works have purchased a large-sized vertical deep well pump from the Hooker-Colville Pump Co., of St. Louis.——Calumet. The Calumet Water Supply Co. was incorporated recently to supply the village of Washington Heights and the town of Calumet with lake water, but an injunction is to be obtained by the village people to prevent the Board of Trustees from making any contract with the company.

Minnesota.—Duluth. The Gas & Water Co. has stated that the First St. reservoir has a capacity of 695,000 galls. that there is a leak in the southwest corner which cannot be repaired until spring, that the reservoir below the leak holds 430,000 galls. that there is no danger and nobody will be inconvenienced if the reservoir is filled to that point, and that it can supply the city direct from the pumps, which have 5,000,000 galls. daily capacity, just as well, but at greater cost. The Committee on Light and Water recommended that the reservoir be cut off until repaired and the city supplied direct from the pumps.

Montana.—Helena. The ordinance has been passed appropriating to the Helena Water Co. $3,445.20 in payment for water furnished the city during September, October and November, 1888.

Arkansas.—Helena. A proposition to build water-works for $60,000 has been made by J. M. FERRY, of St. Louis, Mo., and GEO. WALKER, AARON MYERS, and others, of Helena.——Arkansas City. Proposals for the construction of water-works were received Jan. 17 by SAMUEL MARKS, City Recorder.

Texas.—Waxahachie. Plans and specifications for the water-works are about completed. When adopted by the council, bids will be wanted. For particulars address the mayor.

Colorado.—Las Animas. A contract for water-works has been awarded to F. P. Arbuckle, of Denver, Col., at $28,521.——Telluride. The water-works have proved a paying investment, only half the amount received for rents being required to pay interest on the bonds with which the plant was bought, leaving a good balance for extending the mains and for other expenses.

Washington Territory.—Fairhaven. The Fairhaven Land Co. has been incorporated at Tacoma and will build water-works, etc., at this new town.

Canada.—Windsor, Ont. A large inlet pipe has been ordered and will be laid in the river at once.

Newark, N. J.—The Aqueduct Board opened proposals for the water supply on Jan. 9. The Bartlett Co. renewed its original bid. The Pratt Water Co. offered to give 35,000,000 galls. daily for $4,000,000 a year, and 50,000,000 galls. daily for $4,665,000 a year. The Lehigh Valley Railroad Co., the lessee of the Morris Canal Co., offered 25,000,000 galls. for $4,000,000 a year, and 50,000,000 galls. for $6,000,000 a year. These offers include the construction of buildings, plant, reservoirs, and a complete system of piping.

Drainage in Michigan.—The largest drain ever dug in Lapeer Co., the Black Creek drain, beginning in Elba Township and opening into the Flint River, has been finished. The drain is 9 miles long and 30 ft. wide at some places. It was dug by the County Drain Commissioners of Lapeer and Genesee counties. One principal object of the drain is to lower Potter Lake, a swampy body of water covering about 210 acres. The Hubbard ditch in the north side of Verona has been completed and accepted.

Water-Works in California.—The following petition, originating in San Rafael, has been extensively circulated throughout the State:

To the Hon. the Legislature of the State of California—GENTLEMEN:—We, the undersigned, citizens of the—of—county, respectfully petition your honorable body to pass an act to enable incorporated cities and towns to provide, acquire and maintain public water-works, to issue bonds, to acquire by purchase existing water-works, and the right to appropriate, acquire and condemn under the right of eminent domain, private property or water rights; to construct reservoirs and lay mains and distributing pipes in or outside of their corporate limits.

The petition is to be introduced at the next session of the Legislature.

Special Reports of Water-Works Construction.

SCOTLAND, D. T., Jan. 8, 1889.

EDITOR ENGINEERING NEWS:—We will have an engineer here in a few days to prepare for water-works. The supply will be taken from a spring, close to town, or from an artesian well. We have a population of 2,000.
J. V. TRIBEL, *City Clerk.*

GALVESTON, Neb., Jan. 8, 1889.

EDITOR ENGINEERING NEWS:—S. K. Felton & Co., Omaha, Neb., began the construction of water-works for our town Oct. 20, 1888. They are now two-thirds completed and will be put in operation about Feb. 1, 1889, and will consist of ½ mile of pipe and 7 hydrants. Cost, $5,050. Our population is 800.
L. E. CREWS, *Village Clerk.*

We have received the following information from CHAS. SCHROEDER, of Columbus, Neb., regarding the water-works at David City, and Stromsburg, Neb., for both of which he was constructing engineer and general contractor.

David City.—The water-works were designed by A. A. RICHARDSON, of Lincoln, Neb. Work was begun June 15, 1888, and is now nearly finished. The contract for a 1,000,000-gall. pump was awarded to the Pond Engineering Co., and for pipe and specials to the Ohio Pipe Co. Tamaqua hydrants and Peet valves were used. The supply is from two Cook wells, and water can either be pumped direct or to a stand-pipe 12 ft. in diam. and 100 ft. high. There are 3 miles of cast-iron mains, 20 taps and 22 fire hydrants. The ordinary and fire pressure is 45 lbs. and 100 lbs. respectively. The works will cost $22,000, which amount was raised by the issuing of 5 per cent. bonds.

Stromsburg, Neb.—The stand-pipe is 8 ft. in diam. and 60 ft. high. The works are owned by the city, and the cost $12,000, was raised by 6 per cent. bonds. They are under the control of the mayor and council. Work was begun Sept. 1 and finished Dec. 1, 1888. There is a 500,000-gal. Buffalo pump, furnished by the Pond Engineering Co. The pipe was from Dennis Long & Co. Tamaqua hydrants and Peet valves were used. The supply is obtained from Cook wells, and can be pumped direct or to a stand-pipe. There are 2 miles of cast-iron mains, 16 hydrants, an ordinary pressure of 40, and a fire pressure of 100 lbs. Population, 2,000.

GRANT, Neb., Jan. 11, 1889.

EDITOR ENGINEERING NEWS:—We are trying very hard to get a system of water-works, but as yet we are entirely without a supply, except from a well. We are bound to have a system.
J. L. HEARD.

FULTON, Mo., Jan. 8, 1889.

EDITOR ENGINEERING NEWS:—The designing and constructing engineer and superintendent for the city's water-works will be J. LEACH. Work will be begun Jan. 20, and completed in the fall of '89. A 300,000-gall. deep well pump, from the N. O. Nelson Mfg. Co., St. Louis, Mo., lifts water from an artesian well 800 ft. deep. The water is pumped to a reservoir 80 by 60 ft., by 20 ft. deep, by a 1,000,000 gall. duplex Dean pump. Bonds to the amount of $8,000 have been issued. The cost of the works when completed is estimated at $20,000. The population of our city is 4,000.
W. H. HUMPHREY.

BONHAM, TEX., Jan. 7, 1889.

EDITOR ENGINEERING NEWS:—We are boring for water and will construct water-works as soon as water is obtained.
JAS. K. BLAIR, *City Secretary.*

CREWE, Tex., Jan. 8, 1889.

EDITOR ENGINEERING NEWS:—There is nothing settled or definite in regard to water-works. The question is being agitated, and some steps will be taken soon to put in a system.
D. H. HEATON.
Las Animas, Col.

DENVER, Col., Jan. 6, 1889.

EDITOR ENGINEERING NEWS:—The construction of water-works was begun Jan. 1, and will be completed May 1, 1889. F. P. ARBUCKLE, Denver, is the designing and constructing engineer and superintendent. The supply will be taken from an open well, near the river, pumped direct for fire purposes, and also to a tank which will furnish a 50 ft. head, and have a capacity of 90,000 galls. There will be two compound, non-condensing pumps, of 550,000 galls. capacity, each; 15,600 ft. of cast-iron mains, 30 hydrants and an ordinary and fire pressure of 25 and 100 lbs. respectively. The city, which has a population of 2,000, will own the works, and bonds to cover cost to the amount of $28,500 at 8 per cent. have been issued.
F. P. ARBUCKLE.

MISSOURI VALLEY, Ia., Dec. 31, 1888.

EDITOR ENGINEERING NEWS:—The City Council has voted a franchise, but its provisions are so onerous that it is very doubtful whether anything can be done with it. I have made some preliminary surveys. It is proposed to pump water from driven wells to a reservoir, at an estimated cost of $30,000.
J. S. WATTLES.

Nevada, Ia.—These works were completed in Oct., 1888, with FREMONT TURNER, Nevada, as contractor. Mr. TURNER informs us that the works were designed by WM. BURNHAM, Batavia, Ill., and that the pipe was bought of the Detroit (Mich.) Pipe & Foundry Co.; also that the tank was furnished by U. S. Wind Engine & Pump Co., Batavia, Ill., and that Galvin valves and hydrants are used. The Curtis pump is driven by a windmill.